

Mark Scheme

AQA Level 2 Further Maths Mock Set B Paper 2

For AQA Level 2 Certificate in Further Mathematics (8365)

Paper 2 (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	$5(x+4)^2(2x+5)$	B2 (B1)	$5(x+4)^2(2x+5)$ a correct partial factorisation with $(x+4)^2$ or $5(x+4)$ taken out, e.g. $5(x+4)^2[2(x+4)-3]$ or $(x+4)^2(10x+25)$ or $5(x+4)(2x^2+13x+20)$ <i>Additional guidance:</i> Accept $5(x+4)(x+4)(2x+5)$. $5(x+4)^2(2x+8-3)$ on the answer line scores B1. Fully expanded answers, e.g. $10x^3+105x^2+360x+400$, score B0.
2	B	B1	B
3	$(x+2)^2 + (y+1)^2 = 34$	B3 (B2) (B1)	$(x+2)^2 + (y+1)^2 = 34$ oe, e.g. $(x-(-2))^2 + (y-(-1))^2 = 34$ $(x+2)^2 + (y+1)^2 = k$ with $k \neq 34$ or $(x\dots)^2 + (y\dots)^2 = 34$ or centre $(-2, -1)$ and radius ² = 34 (or radius = $\sqrt{34}$) centre $(-2, -1)$ or radius ² = 34 or radius = $\sqrt{34}$ or [5.83, 5.831] or diameter ² = 136 <i>Additional guidance:</i> $(x+2)^2 + (y+1)^2 = 136$ scores B2 (diameter ² used). $(x-2)^2 + (y-1)^2 = 34$ scores B2. Using half the differences, (5, -3), as the centre scores B0 for the centre. $(x+2)^2 + (y+1)^2 = \sqrt{34}^2$ scores B3. Accept [33.9, 34.1] for 34 only if $\sqrt{34}$ or 34 is seen.
4(a)	$m_{AB} = \frac{1}{2}$, $m_{BC} = -2$, $\frac{1}{2} \times (-2) = -1$, so AB and BC are perpendicular and angle $ABC = 90^\circ$	M1 M1 A1	gradient $AB = \frac{3}{6}$ oe gradient $BC = \frac{-4}{2}$ oe $\frac{1}{2} \times (-2) = -1$ or -2 is the negative reciprocal of $\frac{1}{2}$ oe, and a conclusion, e.g. so AB is perpendicular to BC , or angle $ABC = 90^\circ$ <i>Additional guidance:</i> This is a “show that” question: Pythagoras’ theorem ($AB^2 + BC^2 = AC^2$, i.e. $45 + 20 = 65$) does not use gradients and scores MOMOA0. A0 if there is no conclusion. Gradients may be seen in the equations of the lines, e.g. $y = \frac{1}{2}x + \frac{3}{2}$.
4(b)	15 units ²	M1 A1	$\sqrt{6^2 + 3^2}$ and $\sqrt{2^2 + 4^2}$ oe, or $\sqrt{45}$ and $\sqrt{20}$, or [6.7, 6.71] and [4.47, 4.48] 15 (accept [14.9, 15.1])

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> Alternative: enclosing rectangle $8 \times 4 = 32$ minus three triangles $9 + 4 + 4$ M1, 15 A1. $\frac{1}{2} \times \sqrt{45} \times \sqrt{65}$ or $\frac{1}{2} \times \sqrt{20} \times \sqrt{65}$ (hypotenuse used) scores M0A0.
			Total for Question 4: 5 marks
5(a)	$3n^2 - 2n - 4$	M1 M1dep A1	$3n^2$ or second difference 6 with $a = 3$ oe $-6, -8, -10, -12$ or $-2n - 4$ oe, or two correct equations from $a + b + c = -3, 3a + b = 7, 2a = 6$ $3n^2 - 2n - 4$ <i>Additional guidance:</i> $3n^2 - 2n - 4$ with no working scores 3. $6n^2 \dots$ scores M0. Alternative: $an^2 + bn + c$ with $a + b + c = -3, 4a + 2b + c = 4, 9a + 3b + c = 17$ solved.
5(b)	$m = 19$	M1 A1	their n th term = 1041 and a correct method to solve, e.g. $(n - 19)(3n + 55) = 0$ or $\frac{2 \pm \sqrt{(-2)^2 - 4 \times 3 \times (-1045)}}{2 \times 3}$ oe 19 with no other answer <i>Additional guidance:</i> M1 ft their quadratic n th term from (a). 19 with no working, or from trial (e.g. substituting $n = 19$), scores M0A0. 19 and $-\frac{55}{3}$ both given as the answer scores M1A0. Answer 1041 scores M0A0.
			Total for Question 5: 5 marks
6	$-10.375 \left(-\frac{83}{8}\right)$	M1 M1dep M1 A1	one of $3x^2, -\frac{5}{2}x^{-1}, 4x^{-2}$ oe with powers of x simplified all three of $3x^2, -\frac{5}{2}x^{-1}, 4x^{-2}$ oe at least two of $6x, \frac{5}{2}x^{-2}, -8x^{-3}$ oe (ft their terms of the form kx^n) -10.375 or $-\frac{83}{8}$ or $-10\frac{3}{8}$ with all three derivatives correct <i>Additional guidance:</i> Values only from a calculator's numerical differentiation, with no algebraic derivative seen, score 0. Differentiating the top and bottom separately ($\frac{24x^3-5}{4x}$) scores MOMOMOA0. Substituting $x = -2$ into $y (= 14.25)$ scores 0 unless earlier marks have been earned. $\frac{8}{2x^2}$ written as $16x^{-2}$: M1 for the other terms may still be awarded.
7(a)	Reflection in the line $y = -x$	B1	reflection in (the line) $y = -x$

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> Do not accept reflection in $y = x$, or a rotation. Ignore an extra reference to “the origin”. Two transformations scores B0.
7(b)	$\mathbf{B}^3 = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$: rotation 90° anticlockwise about the origin	B1	$\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$
		B1	rotation, 90° anticlockwise (or 270° clockwise), (centre) the origin <i>Additional guidance:</i> Second B1 can be awarded without the matrix, e.g. from $3 \times 90^\circ = 270^\circ$ clockwise. $\mathbf{B} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ (anticlockwise) leading to $\mathbf{B}^3 = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$ and rotation 90° clockwise about the origin scores B0B0. Rotation with no centre, or “turn”, scores B0 for the description.
Total for Question 7: 3 marks			
8	-4, -3, -2, -1, 0, 1, 2, 3, 4	B2	-4, -3, -2, -1, 0, 1, 2, 3, 4 with no other values
		(B1)	-4, ..., 4 with one other value or eight of these nine values with no other values <i>Additional guidance:</i> SC1 $n^2 < 21.1 \dots$ or $-4 \leq n \leq 4$ or $[-4.6, -4.59] < n < [4.59, 4.6]$ as the answer. Integers in any order. 0, 1, 2, 3, 4 only scores B0 (five of nine). Accept $\pm 1, \pm 2, \dots$
9	$x = \frac{4k-3}{3k+2}, y = \frac{4k^2+2}{3k+2}$	M1	$2x + 3(kx + 1) = 4k$ oe, or eliminates x correctly, e.g. $\frac{2(y-1)}{k} + 3y = 4k$
		M1dep	$x(2 + 3k) = 4k - 3$ or $x = \frac{4k-3}{3k+2}$ oe
		A1	$x = \frac{4k-3}{3k+2}$ and $y = \frac{4k^2+2}{3k+2}$ oe single fractions <i>Additional guidance:</i> Accept equivalent single fractions, e.g. $y = \frac{2(2k^2+1)}{3k+2}$ or $x = \frac{3-4k}{-3k-2}$. $y = \frac{k(4k-3)}{3k+2} + 1$ (not a single fraction) scores M1M1A0. $2x + 3kx$ written as $5kx$ scores M1M0A0. $2x + 3kx + 1 = 4k$ (bracket not expanded) scores M0.
10	$p = 7$	M1	$(-5)^2 + p(-5) - 6$ or $19 - 5p$ oe

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Q	Answer	Marks	Guidance
		M1	$5 - 3p$ and an equation with their $f(-5)$, e.g. $19 - 5p = 5 - 3p$
		A1	7 <i>Additional guidance:</i> $f(3)$ from the first part ($9 + 3p - 6$, giving $p = 2$) M1M0A0. $f(-5)$ from the second part ($5 + 5p$, giving $p = 0$) M0M1A0 if $5 - 3p$ is used for $f(3)$. $(-5)^2$ taken as -25 (giving $p = -18$) M0M1A0. Correct answer with no working M1M1A1.
11	$x^{\frac{7}{6}} + x$ (that is, $a = 7$, $b = 6$, $c = 1$)	B3	$x^{\frac{7}{6}} + x$ or $x^{\frac{7}{6}} + x^1$
		(B2)	$x^{\frac{7}{6}}$ or x as one term of a two-term answer, or $x^{\frac{1}{2}}(x^{\frac{2}{3}} + x^{\frac{1}{2}})$ or $\frac{x^{\frac{19}{6}} + x^3}{x^2}$
		(B1)	$x^{\frac{5}{2}}$ or $x^{\frac{19}{6}}$ or $x^{\frac{1}{2}}$ for $\frac{x^{5/2}}{x^2}$ or x^3 for $x^{\frac{5}{2}} \times x^{\frac{1}{2}}$ <i>Additional guidance:</i> Accept $x^{\frac{14}{12}} + x$ for B2 only (not simplified). $x^{\frac{7}{6}} + x$ followed by an attempt to combine, e.g. $x^{\frac{13}{6}}$, scores B2. $x^{\frac{5}{3}} + x^{\frac{5}{4}}$ (powers multiplied) scores B0.
12	$k = 3.35$	M1	$\frac{1}{3}\pi(2k)^2(5k) = 250\pi$ oe, e.g. $\frac{20}{3}\pi k^3 = 250\pi$
		M1dep	$k^3 = 37.5$ oe, e.g. $k^3 = \frac{750}{20}$, or $\sqrt[3]{37.5}$
		A1	[3.34, 3.35] (answer 3.35) <i>Additional guidance:</i> $2k^2$ for $(2k)^2$ gives $k^3 = 75$ and $k = 4.22$: M0M0A0. Omitting $\frac{1}{3}$ gives $k = 2.32$: M0M0A0. π may be evaluated, e.g. $20.94 \dots k^3 = 785.39 \dots$
13	$x = 1.17$	M1	$(12 + 2x)(7 + 2x) - 12 \times 7 = 50$ oe, e.g. $2(12x) + 2(7x) + 4x^2 = 50$ or $(12 + 2x)(7 + 2x) = 134$
		M1dep	$4x^2 + 38x - 50 (= 0)$ oe and correct substitution into the quadratic formula, or correct completing the square
		A1	[1.17, 1.171] (answer 1.17) with the negative value rejected or not given <i>Additional guidance:</i> $(12 + x)(7 + x) - 84 = 50$ (path counted once) leads to $x = 2.34$ and scores M0M0A0. $(12 + 2x)(7 + 2x) = 50$ (no solution for positive x) scores M0. Answer 1.17 and -10.7 both given scores M1M1A0. Accept [1.17, 1.171] from a calculator equation solver with the correct quadratic seen.

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Q	Answer	Marks	Guidance
14	$-\frac{9y}{2(2y+5)}$	M1	$(2y+5)(y-3)$
		M1	$-3(y-3)$ or $3(3-y)$ oe
		M1dep	multiplies by the reciprocal and reaches a correct single fraction with $(y-3)$ cancelled, e.g. $\frac{-18y^2}{4y(2y+5)}$ or $\frac{6y \times (-3)}{4(2y+5)}$ (dep on M2)
		A1	$-\frac{9y}{2(2y+5)}$ oe, e.g. $\frac{-9y}{4y+10}$ or $\frac{9y}{-4y-10}$ <i>Additional guidance:</i> $\frac{9y}{2(2y+5)}$ (sign lost) scores M1M1M0A0 unless a correct unsimplified fraction is seen first (then M1M1M1A0). Multiplying by $\frac{4y}{9-3y}$ instead of its reciprocal: M1M1 only. $(2y-5)(y+3)$ scores M0 for the first mark. Do not accept $-4.5y$ on the top for A1.
15	20.4°	M1	$\frac{1}{2} \times 12 \times 12 \times \sin BAC = 47$ oe, e.g. $72 \sin BAC = 47$
		M1dep	$\sin BAC = \frac{47}{72}$ or [0.652, 0.653] or [40.7, 40.8]
		M1dep	$\frac{180 - (180 - \text{their } [40.7, 40.8])}{2}$ oe, e.g. $\frac{180 - [139.2, 139.3]}{2}$ or their $[40.7, 40.8] \div 2$
		A1	[20.3, 20.4] (answer 20.4) <i>Additional guidance:</i> [69.6, 69.65] (the acute angle used for angle BAC) scores M1M1M0A0. [139.2, 139.3] or [40.7, 40.8] as the answer scores M1M1M0A0. Alternative: perpendicular height h from A and half-base d with $hd = 47$ and $h^2 + d^2 = 144$ is valid but long; award M marks for equivalent progress.
16	$k = \sqrt[3]{\frac{5y+3}{2y-4}}$	M1	$y(2k^3 - 5) = 3 + 4k^3$ oe, e.g. $2yk^3 - 5y = 3 + 4k^3$
		M1dep	$2yk^3 - 4k^3 = 5y + 3$ oe, e.g. $4k^3 - 2yk^3 = -5y - 3$
		M1dep	$k^3(2y - 4) = 5y + 3$ oe or $k^3 = \frac{5y+3}{2y-4}$
		A1	$k = \sqrt[3]{\frac{5y+3}{2y-4}}$ oe, e.g. $\sqrt[3]{\frac{-5y-3}{4-2y}}$ or $\left(\frac{5y+3}{2y-4}\right)^{\frac{1}{3}}$ <i>Additional guidance:</i> The cube root must clearly cover the whole fraction. Correct answer followed by an incorrect simplification, e.g. $\frac{\sqrt[3]{5y+3}}{2y-4}$, scores M3A0. $2yk^3 - 5y = 3 + 4k^3$ with $5y$ and 3 on the wrong sides: M1 only.

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Q	Answer	Marks	Guidance
17(a)	$a = -7$	M1	$3(-5)^3 + 14(-5)^2 + a(-5) - 10 = 0$ oe, e.g. $-375 + 350 - 5a - 10 = 0$
		A1	-7 <i>Additional guidance:</i> Algebraic division instead of the factor theorem scores MOA0 (the question says use the factor theorem). $f(5) = 0$ used ($a = -143$) scores MOA0. $-375 + 350 - 5a - 10 = 0$ solved as $a = 7$ scores M1A0.
17(b)	$(x + 5)(3x + 2)(x - 1)$	M1	$(x + 5)(3x^2 + bx - 2)$ with $b \neq 0$, or $f(1) = 0$ or $f(-\frac{2}{3}) = 0$ shown
		M1dep	$3x^2 - x - 2$ or two of $(x + 5)$, $(3x + 2)$, $(x - 1)$ identified as factors
		A1	$(x + 5)(3x + 2)(x - 1)$ <i>Additional guidance:</i> Algebraic division is allowed in this part. Answer $x = -5, -\frac{2}{3}, 1$ only scores M1M1A0. ft their a from (a) for M1 only. $(x + 5)(x + \frac{2}{3})(x - 1)$ scores M1M1A0.
Total for Question 17: 5 marks			
18	Reflex $AOC = 2x$, so $AOC = 360^\circ - 2x$; $OAC = x - 90^\circ$ (isosceles); $w = 180^\circ - (x - 90^\circ) = 270^\circ - x$, with reasons	M1	reflex angle $AOC = 2x$ (may be seen on the diagram)
		M1	angle $AOC = 360 - 2x$ oe
		M1dep	angle $OAC = \frac{180 - (360 - 2x)}{2}$ or $x - 90$ oe (dep on 2nd M1)
		M1dep	$w = 180 - (x - 90)$ oe, e.g. $w + x - 90 = 180$ (dep on 3rd M1)
		A1	$w = 270 - x$ with M4 and all reasons given: angle at centre is twice angle at circumference; angles around a point; base angles of an isosceles triangle (or $OA = OC$, radii) with angles in a triangle; angles on a straight line

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> Alternative: a point D on the major arc with angle $ADC = 180 - x$ (opposite angles of a cyclic quadrilateral) M1, angle $AOC = 2(180 - x)$ (angle at centre) M1, then as above. Alternative: tangent at A ; angle between tangent and AC equals the angle in the alternate segment, with radius $\perp$ tangent: award equivalent marks. Allow “angle at centre = $2 \times$ angle at circumference”, “isos triangle”, “angles on a line”. Do not accept incorrect or made-up theorem names. Angles may be shown on the diagram if their positions are clear. $w = 270 - x$ with no reasons, or one missing, scores M4A0.
19	109.0°	M1 M1 M1 M1dep A1	$AP^2 = 11^2 + 8^2$ or 185 or $AP = [13.6, 13.61]$ $PG^2 = 6^2 + 4^2$ or 52 or $PG = [7.21, 7.22]$ $AG^2 = 11^2 + 6^2 + 12^2$ or 301 or $AG = [17.34, 17.35]$ $\cos APG = \frac{185 + 52 - 301}{2\sqrt{185}\sqrt{52}}$ oe with their three lengths or $[-0.327, -0.326]$ (dep on at least M2) [109, 109.05] (answer 109.0) <i>Additional guidance:</i> Using $BP = 4$ ($PF = 8$) gives $AP^2 = 137$, $PG^2 = 100$ and [105.8, 105.9]: M0M0M1M1A0. [70.9, 71] (sign of the cosine lost) scores M4A0. Premature rounding of lengths may give an answer outside the range: A0.
20	(-1, 18)	M1 A1 M1 A1	$6x^2 + 2kx - 24$ (at least two terms correct) $k = -9$ from $6(4)^2 + 2k(4) - 24 = 0$ oe their $\frac{dy}{dx} = 0$ solved, e.g. $6(x - 4)(x + 1) = 0$ or $x = -1$ (their k must give a 3-term quadratic) (-1, 18) <i>Additional guidance:</i> (4, -107) (the given stationary point) as the answer M1A1M0A0. $x = -1$ with y not found or wrong M1A1M1A0. k from substituting $x = 4$ into y (eg $y = 0$) M0A0, then M1 for solving their $\frac{dy}{dx} = 0$ is still available. Correct answer with no working scores 0.
21	$x = 0.476$ or $x = -2.92$	B1 M1	$f^{-1}(x) = \frac{x+4}{3}$ oe (may be in terms of y) $3(2x^2 + 5x - 1) - 4$ or $6x^2 + 15x - 7$ oe

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Q	Answer	Marks	Guidance
		M1	their $fg(x)$ = their $f^{-1}(x)$ with the fraction cleared, e.g. $18x^2 + 45x - 21 = x + 4$ oe
		A1	$18x^2 + 44x - 25 = 0$ oe
		M1	correct substitution into the quadratic formula for their 3-term quadratic, e.g. $\frac{-44 \pm \sqrt{44^2 - 4 \times 18 \times (-25)}}{2 \times 18}$ oe
		A1	[0.475, 0.476] and [-2.921, -2.92] <i>Additional guidance:</i> $gf(x) = 18x^2 - 33x + 11$ used instead of $fg(x)$ (giving $54x^2 - 100x + 29 = 0$, $x = 1.49$ or 0.360) B1MOM1A0M1A0. $f^{-1}(x) = 3x + 4$ or $\frac{1}{3x-4}$ B0, other marks ft. Only one correct answer A0. Answers only (e.g. from a calculator equation solver) with no working score 0.
22	$\frac{9 \sin^2 x}{3 \sin x \cos x} = \frac{3 \sin x}{\cos x} = 3 \tan x$, so $k = 3$	M1	$7(1 - \cos^2 x) = 7 \sin^2 x$ or $7 - 7 \cos^2 x = 7 \sin^2 x$ oe, or $9 \sin^2 x$ as the numerator
		M1dep	$\frac{9 \sin^2 x}{3 \sin x \cos x} = \frac{3 \sin x}{\cos x}$ oe
		A1	$3 \tan x$ with $\tan x = \frac{\sin x}{\cos x}$ used and no errors seen (and $k = 3$ stated or clear) <i>Additional guidance:</i> Substituting a value of x , e.g. $x = 45^\circ$, scores MOMOA0. $7 - 7 \cos^2 x = 7 \sin x$ or $7 - 7 \cos^2 x = 0$ scores M0. Alternative: write everything in terms of $\cos x$ ($9 - 9 \cos^2 x$) then $9(1 - \cos^2 x) = 9 \sin^2 x$: M1, then as above.