

Mark Scheme

AQA Level 2 Further Maths Mock Set A 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)	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	$w = -\frac{17}{20}$ (or -0.85)	M1	$(w + 4)(2w + 5) = (w - 3)(2w - 1)$ oe
		M1dep	$2w^2 + 13w + 20 = 2w^2 - 7w + 3$ oe or $20w = -17$ oe
		A1	$-\frac{17}{20}$ or -0.85 oe <i>Additional guidance:</i> Up to M2 may be awarded for correct work with no answer or an incorrect answer. Missing brackets must be recovered. $w + 4 = w - 3$ and $2w - 1 = 2w + 5$ (equating tops and bottoms) scores M0. $\frac{17}{20}$ or 0.85 (sign error) scores M1M1A0 if $20w = 17$ follows a correct expansion; otherwise M1M0A0.
2(a)	$y = 0.6x + 8.4$ (or $y = \frac{3}{5}x + \frac{42}{5}$)	M1	gradient of $L = -\frac{5}{3}$ oe or $y = -\frac{5}{3}x + \frac{8}{3}$
		M1dep	$y - 6 = \frac{3}{5}(x + 4)$ oe or $6 = \frac{3}{5} \times (-4) + c$ oe
		A1	$y = 0.6x + 8.4$ oe in the form $y = mx + c$ <i>Additional guidance:</i> Accept $y = \frac{3}{5}x + \frac{42}{5}$ or $y = \frac{3}{5}x + 8.4$ for A1. $y = \frac{3x+42}{5}$ or $5y = 3x + 42$ (not in the form $y = mx + c$) scores M1M1A0. Using gradient $\frac{5}{3}$ or $-\frac{3}{5}$ scores M1M0A0 at most (M1 only if $-\frac{5}{3}$ is seen).
2(b)	11.7	M1	$x = -14$ or $(-14, 0)$ or $\sqrt{(-4 + 14)^2 + 6^2}$ oe ft their line
		A1ft	[11.6, 11.7] ft their line in (a) (non-zero gradient) <i>Additional guidance:</i> Accept $2\sqrt{34}$ or $\sqrt{136}$ with [11.6, 11.7] seen. 136 or $\sqrt{136}$ alone as the answer scores M1A0.
Total for Question 2: 5 marks			
3	$\frac{3x+2}{x+6}$	M1	$(3x + 2)(2x - 5)$
		M1	$(2x - 5)(x + 6)$
		A1	$\frac{3x+2}{x+6}$ <i>Additional guidance:</i> Further incorrect cancelling after $\frac{3x+2}{x+6}$ is seen (e.g. $\frac{3x+2}{x+6} = \frac{2}{6}$ or $\frac{3+2}{6}$) scores M1M1A0. $\frac{(3x+2)}{(x+6)}$ with brackets is fine. Factorising only one of numerator or denominator correctly scores M1M0A0.

(continued)

Q	Answer	Marks	Guidance
4(a)	$3p + (4n - 5)q$ (or $3p + 4nq - 5q$)	B2 (B1)	$3p + (4n - 5)q$ oe e.g. $3p - q + 4q(n - 1)$ or $3p + 4nq - 5q$ $4nq$ or $4q(n - 1)$ or $3p + 4nq + kq$ ($k \neq -5$) seen <i>Additional guidance:</i> Ignore further incorrect simplification after a correct expression is seen. $3p + 4nq - 5$ (missing q in the constant term) scores B1.
4(b)	$p = -1, q = 2.5$	M1 A1	$3p + 15q = 34.5$ and $3p + 43q = 104.5$ oe (ft their n th term) or $28q = 70$ oe $p = -1$ and $q = 2.5$ <i>Additional guidance:</i> For M1 the two equations must come from their n th term in the form $3p + (an + b)q$ with $a \neq 0$. $q = 2.5$ only scores M1A0.
Total for Question 4: 4 marks			
5	$k = -2.5$	M1 M1dep A1	$5x^4$ or $3kx^2$ $5 \times (-2)^4 + 3k \times (-2)^2 = 50$ oe or $80 + 12k = 50$ or $12k = -30$ -2.5 oe e.g. $-\frac{5}{2}$ <i>Additional guidance:</i> For M1dep their derivative must have two terms, one in x only and one in k and x . $(-2)^5 + k(-2)^3 = 50$ (substituting into y ; $k = -10.25$) scores MOMOAO. $-80 + 12k = 50$ scores M1MOAO.
6	1512	B3 (B2) (B1)	1512 $3 \times 4 \times 8 \times 7$ and $3 \times 5 \times 8 \times 7$ or 672 and 840 (or a complete correct alternative split) $3 \times 4 \times 8 \times 7$ or 672 or $3 \times 5 \times 8 \times 7$ or 840 <i>Additional guidance:</i> Products may be in any order. Alternative: split by the last digit. Last digit 0: $6 \times 8 \times 7 = 336$; last digit 4, 6 or 8: $3 \times 5 \times 8 \times 7 = 840$; last digit 2: $6 \times 8 \times 7 = 336$ (any two correct B1, all three correct B2). Up to B2 may be awarded for correct work with no answer or an incorrect answer. SC1 for 1680 ($6 \times 5 \times 8 \times 7$, the overlap of the first and last digits ignored). 3024 ($6 \times 9 \times 8 \times 7$, even condition ignored) scores B0. Ignore attempts to list codes.
7(a)	$\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$	B1	$\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$

(continued)

Q	Answer	Marks	Guidance
7(b)	Rotation, 90° anticlockwise, about the origin (matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$)	M1	$\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$
		A1	$\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$
		B1ft	rotation, 90° anticlockwise (or 270° clockwise), about the origin ft their 2 × 2 matrix if it represents a rotation <i>Additional guidance:</i> Accept (0, 0) or <i>O</i> for the origin. Accept a quarter turn anticlockwise. $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$ (wrong order) with “rotation 90° clockwise about the origin” scores MOA0B1ft. A correct description with no matrix work scores B1 only (the question says use matrix multiplication). Any combination of transformations scores B0.
Total for Question 7: 4 marks			
8(a)	$a = 3.2, b = 1.5$	M1	$ab^2 = 7.2$ and $ab^5 = 24.3$ oe
		M1dep	$b^3 = \frac{24.3}{7.2}$ oe or $b^3 = 3.375$ or $b = 1.5$
		A1	$a = 3.2$ and $b = 1.5$ <i>Additional guidance:</i> $b = 1.5$ with a incorrect or missing scores M1M1A0. Accept $a = \frac{16}{5}$ and $b = \frac{3}{2}$.
8(b)	$1.42 \leq f(x) \leq 16.2$ (lower end $\frac{64}{45}$)	B2ft	$[1.42, 1.423] \leq f(x) \leq 16.2$ oe ft their a and b from (a) ($b > 0, b \neq 1$)
		(B1ft)	$[1.42, 1.423]$ or $\frac{64}{45}$ or 16.2 seen as a value of f <i>Additional guidance:</i> Accept y for $f(x)$. $1.42 \leq x \leq 16.2$ scores B1. $16.2 \leq f(x) \leq 1.42$ scores B1. $1.42 < f(x) < 16.2$ scores B1. The range of values $16.2 - 1.42 = 14.78$ scores B0 unless both ends are seen (then B1).
Total for Question 8: 5 marks			
9	$(2n + 3)^2 - (2n + 1)^2 = 8n + 8 = 4(2n + 2)$, and $2n + 2$ is the even number between them	M1	$4n^2 + 12n + 9$ or $4n^2 + 4n + 1$
		M1dep	$(4n^2 + 12n + 9) - (4n^2 + 4n + 1)$ and $8n + 8$

(continued)

Q	Answer	Marks	Guidance
		A1	$2n + 2$ identified as the even number between them and $8n + 8 = 4(2n + 2)$ oe with a conclusion <i>Additional guidance:</i> Alternative using the difference of two squares: $(2n + 3 - (2n + 1))(2n + 3 + 2n + 1)$ M1, $= 2(4n + 4)$ or $8n + 8$ M1, $= 4(2n + 2)$ with conclusion A1. Condone $(2n + 1)^2 - (2n + 3)^2 = -8n - 8$ if the conclusion refers to the size of the difference. Missing brackets must be recovered: $4n^2 + 12n + 9 - 4n^2 + 4n + 1 = 16n + 10$ scores M1MOA0. Numerical examples only score 0.
10	3:4	M1	$2x(3x + y)$ or $\frac{1}{2} \times 5x(4y - x)$ oe
		M1dep	$5 \times 2x(3x + y) = 4 \times \frac{1}{2} \times 5x(4y - x)$ oe or $40x^2 = 30xy$ oe
		A1	3:4 <i>Additional guidance:</i> Accept $\frac{x}{y} = \frac{3}{4}$ only if 3:4 is not contradicted. 4:3 (ratio inverted after a correct equation) scores M1M1A0. $4 \times \text{rectangle} = 5 \times \text{triangle}$ ($36.5x^2 = 42xy$, $x:y = 84:73$) scores M1MOA0. Missing $\frac{1}{2}$: $5(6x^2 + 2xy) = 4(20xy - 5x^2)$ gives $50x^2 = 70xy$, $x:y = 7:5$, and scores M1MOA0 (M1 for the rectangle's area).
11	$k = 2.27$	M1	$4 \times \pi \times 6^2$ or 144π or $[452, 453]$ or $2\pi(2k)^2 + 2\pi \times 2k \times 5k$ or $28\pi k^2$
		M1dep	$28\pi k^2 = 144\pi$ oe or $k^2 = \frac{36}{7}$ or $k^2 = [5.14, 5.143]$
		A1	$[2.26, 2.27]$ <i>Additional guidance:</i> Up to M2 may be awarded for correct work with no answer or an incorrect answer. One circular end only ($24\pi k^2$, $k = 2.45$) or curved surface only ($20\pi k^2$, $k = 2.68$) scores M1MOA0. $2\pi \times 2k^2$ for the ends ($24\pi k^2$) scores M1MOA0. Exact answer $\frac{6\sqrt{7}}{7}$ with $[2.26, 2.27]$ seen scores 3.
12(a)	$\frac{21}{v - 2.5} - \frac{21}{v} = 0.25$ leads to $2v^2 - 5v - 420 = 0$	M1	$\frac{21}{v - 2.5} - \frac{21}{v} = 0.25$ oe or $\frac{21}{v} + \frac{15}{60} = \frac{21}{v - 2.5}$ oe

(continued)

Q	Answer	Marks	Guidance
		A1	correct clearing of fractions, e.g. $84v - 84(v - 2.5) = v(v - 2.5)$ or $21v - 21(v - 2.5) = 0.25v(v - 2.5)$, leading to $2v^2 - 5v - 420 = 0$ with no errors <i>Additional guidance:</i> This is a “show that” question: the final equation must follow from correct working with no errors or omissions. Using 15 for the time ($\frac{21}{v-2.5} - \frac{21}{v} = 15$) scores M0. Working backwards from the given equation scores 0.
12(b)	$v = 15.8$	M1	$\frac{-(-5) \pm \sqrt{(-5)^2 - 4 \times 2 \times (-420)}}{2 \times 2}$ oe or $\frac{5 \pm \sqrt{3385}}{4}$ or $(v - \frac{5}{4})^2 = \frac{25}{16} + 210$ oe
		A1	[15.79, 15.8] or [-13.3, -13.29]
		A1	15.8 only (negative solution rejected or not given) <i>Additional guidance:</i> Condone + for $\pm$ in the formula. 15.8 and -13.3 both given as the answer scores M1A1A0. 15.8 with no working scores M1A1A1 (working is not required in this part).
Total for Question 12: 5 marks			
13	80°	M1	angle $ABC = \frac{1}{2}(5x - 15)$ oe or reflex angle $AOC = 360 - (5x - 15)$ oe
		M1dep	$\frac{1}{2}(5x - 15) + 3x - 5 = 180$ oe or $2(3x - 5) = 360 - (5x - 15)$ oe
		A1	$x = 35$
		A1	80 <i>Additional guidance:</i> Alternative: reflex angle $AOC = 2 \times$ angle ADC , so $2(3x - 5) = 375 - 5x$ (M1M1), $x = 35$ (A1), then angle $ABC = 180 - 100 = 80$ (A1). $5x - 15 = 3x - 5$ ($x = 5$) or $5x - 15 = 2(3x - 5)$ ($x = -5$) scores M0. 35 as the final answer scores M1M1A1A0.
14	$a = 1.25$ or $a = -1.25$	M1	10 or 5C_2 or 1 5 10 10 5 1 seen
		M1	$10 \times 4^3 \times (ax)^2$ oe or $640a^2$ (may be embedded in a full expansion)
		M1dep	$640a^2 = 1000$ or $a^2 = \frac{1000}{640}$ or $a^2 = 1.5625$ oe
		A1	1.25 and -1.25 oe

(continued)

Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> $10 \times 4^3 \times a = 1000$ ($a = 1.5625$) scores M1M0M0A0. $10 \times 4^2 \times a^2$ (wrong power of 4) scores M1M0M0A0. 1.25 only scores M1M1M1A0. Accept $\pm \frac{5}{4}$.
15(a)	$x^2 + 4xh = 1500$, so $h = \frac{1500-x^2}{4x}$ and $V = x^2h = 375x - 0.25x^3$	M1	$x^2 + 4xh = 1500$ oe
		A1	$h = \frac{1500-x^2}{4x}$ oe and $V = x^2 \times \frac{1500-x^2}{4x}$ oe leading to $V = 375x - 0.25x^3$ with no errors <i>Additional guidance:</i> Starting from $2x^2 + 4xh = 1500$ scores M0A0. Accept $V = 375x - \frac{x^3}{4}$ or $\frac{1}{4}x^3$.
15(b)	5590 cm^3 (a maximum, as $\frac{d^2V}{dx^2} = -33.5 \dots < 0$)	M1	$375 - 0.75x^2$ oe
		M1dep	$375 - 0.75x^2 = 0$ and $x^2 = 500$ or $x = [22.3, 22.4]$ or $x = 10\sqrt{5}$
		A1	[5590, 5591]
		B1	$\frac{d^2V}{dx^2} = -1.5x$ and negative at their positive x , e.g. [-33.6, -33.5], so maximum oe <i>Additional guidance:</i> B1 is independent: accept a correct sign test of $\frac{dV}{dx}$ either side of $x = 22.36$ (e.g. $x = 22$: 12; $x = 23$: -21.75) with a conclusion. A sketch or "it is a negative cubic" alone is not a test. 22.4 (the value of x) as the answer scores M1M1A0 (+B1 if earned). Values of V found by trial with no calculus score 0.
Total for Question 15: 6 marks			
16	$a = 2.5$, $b = -3$, $c = 1$	M1	correct equation in two variables with terms collected, e.g. $2b - 13c = -19$
		M1dep	a second correct equation in the same two variables, e.g. $b + c = -2$
		M1dep	correct equation in one variable, e.g. $15c = 15$
		A1	correct equation in one variable and any two of $a = 2.5$, $b = -3$, $c = 1$
		A1	$a = 2.5$, $b = -3$, $c = 1$ oe

(continued)

Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> Some correct equations in two variables: $2b - 13c = -19$, $b + c = -2$ (or $-5b - 5c = 10$), $19b - 11c = -68$, $26a + 21b = 2$, $22a + 12b = 19$, $2a - 3b = 14$, $4a + 21c = 31$, $2a + 3c = 8$. All equations have equivalents. M3 can be implied if two variables are eliminated in one step. Correct values only, with no working, score 0. Escalate any matrix method.
17	54.0 cm ²	M1 M1dep M1dep A1	$\frac{\sin B}{9.7} = \frac{\sin 57}{11.4}$ oe or $\sin B = [0.713, 0.714]$ $B = [45.5, 45.53]$ $\frac{1}{2} \times 9.7 \times 11.4 \times \sin(180 - 57 - \text{their } B)$ oe or $\frac{1}{2} \times 9.7 \times 11.4 \times \sin[77.4, 77.5]$ [53.9, 54.0] <i>Additional guidance:</i> Up to M3 may be awarded for correct work with no answer or an incorrect answer. Alternative for the third mark: $AB = \frac{11.4 \sin C}{\sin 57} = [13.2, 13.27]$ and $\frac{1}{2} \times 9.7 \times [13.2, 13.27] \times \sin 57$. Alternative using the cosine rule: $11.4^2 = 9.7^2 + AB^2 - 2 \times 9.7 \times AB \times \cos 57^\circ$ (M1), solving the quadratic gives $AB = [13.2, 13.27]$ (M1), $\frac{1}{2} \times 9.7 \times AB \times \sin 57^\circ$ (M1), 54.0 (A1). $\frac{1}{2} \times 9.7 \times 11.4 \times \sin 57 = 46.4$ scores MOMOMOA0.
18	$x = \frac{1}{2}$ or $x = -1$	M1 M1dep M1dep A1	$5^{2x(x+2)}$ or 5^{3x+1} or 5^{3x} oe (one side correctly as a power of 5) $2x(x+2) = 3x+1$ oe $2x^2 + x - 1 = 0$ and $(2x-1)(x+1)$ or a correct substitution into the formula $\frac{1}{2}$ and -1 oe <i>Additional guidance:</i> Working in powers of 25 or 125 is acceptable if correct, e.g. $25^{x(x+2)} = 25^{\frac{3x+1}{2}}$. Missing the 5 ¹ : $2x^2 + 4x = 3x$ gives $x = 0$ or $x = -\frac{1}{2}$ and scores M1MOMOA0. 5^{x^2+2x} for the left-hand side (base changed without doubling the power) is not a correct power of 5: M1 can then only be earned for 5^{3x+1} or 5^{3x} , and the method marks that follow are lost. Answers only score 0.
19	53.2°	M1 M1dep	$18^2 + 11^2$ or 445 or $\frac{1}{2}\sqrt{445}$ or [10.5, 10.55] or $16^2 - 5.5^2$ or 225.75 $\sqrt{16^2 - 111.25}$ or [12, 12.04] or $\sqrt{225.75}$ or [15, 15.03]

(continued)

Q	Answer	Marks	Guidance
		M1	9 used as the distance from the centre to BC (or as half of AB in a right-angled triangle with the face)
		M1dep	$\tan \theta = \frac{[12, 12.04]}{9}$ oe or $\cos \theta = \frac{9}{[15, 15.03]}$ oe
		A1	[53.1, 53.3] <i>Additional guidance:</i> Alternative route without the height: the height of face EBC is $EM = \sqrt{16^2 - 5.5^2} = \sqrt{225.75} = [15, 15.03]$ (M1M1), $XM = 9$ (M1), $\cos \theta = \frac{9}{15.02...}$ (M1), 53.2 (A1). Using 5.5 for XM ($\tan \theta = \frac{12.03}{5.5}$, angle 65.4° , which is the angle for face EAB) scores M1M1MOMOA0. [48.7, 48.8] (angle between edge EC and the base) scores M1M1MOMOA0.
20	40.2°, 139.8°, 220.2°, 319.8°	M1	$3 \sin^2 x + 4 = 9(1 - \sin^2 x)$ oe or $3(1 - \cos^2 x) + 4 = 9 \cos^2 x$ oe or $7 \sin^2 x = 5 \cos^2 x$ oe
		M1dep	$\sin^2 x = \frac{5}{12}$ or $\sin x = \pm[0.645, 0.6455]$ or $\cos^2 x = \frac{7}{12}$ or $\tan^2 x = \frac{5}{7}$ oe
		A1	any two of [40.2, 40.21], [139.79, 139.8], [220.2, 220.21], [319.79, 319.8]
		A1	40.2, 139.8, 220.2 and 319.8 and no others in the range <i>Additional guidance:</i> Alternative: $4 = 4 \sin^2 x + 4 \cos^2 x$ gives $7 \sin^2 x = 5 \cos^2 x$, $\tan x = \pm 0.845 \dots$ (M1M1). Ignore solutions outside $0^\circ \leq x \leq 360^\circ$. Answers only (no working) score 0. Using $\cos^2 x = 1 + \sin^2 x$ or $\cos x = 1 - \sin x$ scores M0.