

Mark Scheme

AQA Level 2 Further Maths Mock Set C 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	$x^3 + 10x^2 - 37x + 14$	M1	at least 5 terms correct from $3x^3 + 2x^2 - 12x^2 - 8x + 21x + 14$ or $3x^3 - 10x^2 + 13x + 14$ (may be seen in a grid)
		M1	$2x^3 - 20x^2 + 50x$ or $2x^3 - 10x^2 - 10x^2 + 50x$ oe
		A1	$x^3 + 10x^2 - 37x + 14$ <i>Additional guidance:</i> Terms may be in any order. A correct term includes its sign. Each M1 may be awarded even if the expression is then simplified incorrectly. $x^3 - 30x^2 + 63x + 14$ (only the first term of $2x^3 - 20x^2 + 50x$ subtracted) scores M1M1A0. Using $(x - 5)^2 = x^2 + 25$ gives $x^3 - 10x^2 - 37x + 14$ and scores M1MOA0.
2	Centre $(-3, 8)$, radius 12	B1	$(-3, 8)$
		B1	12 <i>Additional guidance:</i> Do not accept 144 or ± 12 for the radius. $(3, -8)$ scores B0 for the centre.
3	$2 \leq g(x) < 29$	B2	$2 \leq g(x) < 29$
		(B1)	$2 \leq g(x)$ or $g(x) < 29$, or 2 and 29 both seen <i>Additional guidance:</i> Accept $f(x)$ or y for $g(x)$. $2 < g(x) \leq 29$ (signs not swapped) scores B1. $2 \leq g(x) \leq 29$ scores B1. $2 \leq x < 29$ scores B1. $29 > g(x) \geq 2$ scores B2. -19 (from $5 - 24$) as an end value scores at most B1.
4(a)	$h = -1, k = 5$	B1	$h = -1$
		B1	$k = 5$ <i>Additional guidance:</i> $h = 17$ (from $\frac{h-9}{2} = 4$) scores B0. Allow the values seen on a diagram or as $A(-1, -3)$ and $B(9, 5)$ if not contradicted on the answer line.
4(b)	$y = -1.25x + 6$ (or $y = -\frac{5}{4}x + 6$)	M1	gradient of $AB = \frac{5-3}{9-1}$ or 0.8 oe (ft their h and k)
		M1dep	$y - 1 = -1.25(x - 4)$ or $1 = -1.25 \times 4 + c$ oe (their perpendicular gradient with $(4, 1)$)
		A1	$y = -1.25x + 6$ oe

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> Accept $y = -\frac{5}{4}x + 6$ or $y = -\frac{10}{8}x + 6$. The answer must be in the form $y = mx + c$ for A1. $y = 0.8x - 2.2$ (the line AB) scores M1M0A0. Using gradient -1.25 through A or B scores M1M0A0.
Total for Question 4: 5 marks			
5	$a = -2, b = -3.5$	M1	$5a - 4 = -14$ or $-a = 2$ or $15 + 2b = 8$ or $3 + ab = 10$ oe
		A1	$a = -2$
		A1	$b = -3.5$ oe
			<i>Additional guidance:</i> The expressions $5a - 4$, $-a$, $15 + 2b$ or $3 + ab$ seen in a matrix do not imply M1 unless an equation is formed or a value follows. $b = -3.5$ may come from $3 + ab = 10$ with their a . Accept $-\frac{7}{2}$.
6(a)	1.5	B1	1.5 oe
			<i>Additional guidance:</i> Accept $\frac{6}{4}$ or $\frac{3}{2}$.
6(b)	$k = 95$	M1	$\frac{6k+5}{4k-5} = 1.5 + \frac{1}{30}$ oe or $\frac{6k+5}{4k-5} = \frac{23}{15}$ oe (ft their limiting value)
		M1dep	$15(6k+5) = 23(4k-5)$ oe or $90k+75 = 92k-115$ oe
		A1	95
			<i>Additional guidance:</i> The question says "You must show your working": 95 from trying values with no algebra scores MOM0A0. $1.5 - \frac{1}{30} = \frac{22}{15}$ used (giving $k = -92.5$) scores MOM0A0. Premature rounding of $\frac{23}{15}$ to 1.53 (giving $k = 105.4 \dots$) scores M1M1A0.
Total for Question 6: 4 marks			
7	$x < -3.5$ or $x > 2$	M1	$x < -3.5$ or $x > 2$ (either one)
		A1	$x < -3.5$ and $x > 2$
			<i>Additional guidance:</i> Condone $\leq$ or $\geq$ for M1 only. $-3.5 < x < 2$ scores M0A0. $-3.5 > x > 2$ scores M1A0. Accept $\{x < -3.5\} \cup \{x > 2\}$.
8	196	B3	196
		(B2)	$4 \times 7 \times 7 \times 1$ oe with at least three of the four factors correct

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Q	Answer	Marks	Guidance
		(B1)	$4 \times 7 \times 7 \times 1$ with at least two factors correct, or 4 and 1 identified as the choices for the first and last digits <i>Additional guidance:</i> Products may be in any order. 392 ($4 \times 7 \times 7 \times 2$) scores B2. 245 ($5 \times 7 \times 7 \times 1$) scores B2. 1372 ($4 \times 7 \times 7 \times 7$) scores B2. 343 ($7 \times 7 \times 7 \times 1$) scores B2. 80 (no repetition: $4 \times 5 \times 4 \times 1$) scores B1. Ignore attempts to list serial numbers.
9	-11.5	M1	$12x^3$ or $+6x^{-4}$ oe
		A1	$12x^3 + 6x^{-4}$ oe
		M1	correctly differentiates their two-term $\frac{dy}{dx}$, at least one term containing a negative power of x (ft)
		A1	-11.5 or [-11.49, -11.48] <i>Additional guidance:</i> Accept $\frac{6}{x^4}$ for $6x^{-4}$ and $-\frac{24}{x^5}$ for $-24x^{-5}$. A sign error giving $\frac{dy}{dx} = 12x^3 - 6x^{-4}$, then $36x^2 + 24x^{-5}$ and [69.8, 69.81], scores M1A0M1A0. Substituting $x = 0.9$ into $\frac{dy}{dx}$ only ([17.89, 17.9]) scores M1A1M0A0.
10(a)	$\frac{2b^5}{a}$ (or $2a^{-1}b^5$)	B2	$\frac{2b^5}{a}$ or $2a^{-1}b^5$
		(B1)	$36a^6b^4$ seen, or an answer of the form ka^mb^n with two of $k = 2, m = -1, n = 5$ correct <i>Additional guidance:</i> $12b^5a^{-1}$ (from $6^2 = 36$ not used) scores B1. $2ab^5$ scores B1.
10(b)	$y = p^{-2}q^4$	M1	$y^{\frac{3}{2}} = p^{-3}q^6$ oe, e.g. $y^{1.5} = \frac{q^6}{p^3}$
		A1	$y = p^{-2}q^4$ oe <i>Additional guidance:</i> Accept $m = -2, n = 4$. $y\sqrt{y}$ taken as $y^{\frac{1}{2}}$ (giving $y = p^{-6}q^{12}$) scores M0A0. $y^{\frac{3}{2}} = p^{-3}q^6$ followed by $y = p^{-4.5}q^9$ (multiplying by $\frac{3}{2}$) scores M1A0.
Total for Question 10: 4 marks			
11	$w = \frac{8k}{v^3 - 8}$	M1	$\frac{v^3}{8} = \frac{w+k}{w}$ or $v^3w = 8(w+k)$ oe
		M1dep	$w(v^3 - 8) = 8k$ oe (collects the w terms and factorises)
		A1	$w = \frac{8k}{v^3 - 8}$ oe

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> Accept $w = \frac{-8k}{8-v^3}$ or $w = \frac{8k}{v^3-2^3}$. $w = \frac{8k}{v^3} - 8$ scores M1M1A0 unless the correct form is seen first. $\frac{v^3}{2} = \frac{w+k}{w}$ (2 not cubed) scores M0, but $w = \frac{2k}{v^3-2}$ from it scores SC1. Answer $\frac{8k}{v^3-8}$ without $w =$ scores full marks.
12(a)	$24 - 5(x-2)^2$	B1 B1 B1	$b = 5$ or $4 - 5(x^2 - 4x)$ oe $c = 2$ $a = 24$ <i>Additional guidance:</i> Alternative: expanding $a - b(x-c)^2 = a - bc^2 + 2bcx - bx^2$ and comparing coefficients: $b = 5$ B1, $2bc = 20$ so $c = 2$ B1, $a - bc^2 = 4$ so $a = 24$ B1. $24 - 5(x+2)^2$ scores B1B0B1. $-16 - 5(x-2)^2$ (from $4 - 20$) scores B1B1B0.
12(b)	(2, 24)	B1ft	(2, 24) ft their (c, a)
Total for Question 12: 4 marks			
13	14.1 cm	M1 M1dep A1	$\frac{7.4}{\tan 57}$ or $7.4 \tan 33$ or [4.80, 4.81] oe $\sqrt{7.4^2 + \left(\frac{5}{2} \times \text{their } DC\right)^2}$ oe or $BD = [12.01, 12.02]$ used with Pythagoras or trigonometry in triangle ABD [14.1, 14.12] <i>Additional guidance:</i> Up to M2 may be awarded for correct work with no answer or an incorrect answer. $7.4 \tan 57$ for DC (11.39 ...) scores M0M0A0. $BD = \frac{2}{5} \times DC$ (ratio reversed, $AB = 7.65 \dots$) scores M1M0A0. $\frac{7}{2} \times DC$ used as BD ($AB = 18.4 \dots$) scores M1M0A0.
14(a)	$\frac{1}{2}(2x+25)(x-10) = 2000$, so $2x^2 + 5x - 250 = 4000$, which gives $2x^2 + 5x - 4250 = 0$	M1 A1	$\frac{1}{2}(x+x+25)(x-10) = 2000$ oe $2x^2 - 20x + 25x - 250 = 4000$ or $2x^2 + 5x - 250 = 4000$ oe seen, leading to $2x^2 + 5x - 4250 = 0$ with no errors

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> Working backwards from the given equation scores M0A0 unless fully reversed with a correct area statement. $\frac{1}{2}(x + x + 25) \times (x - 10)$ without = 2000 scores M0 unless the equation is formed later.
14(b)	34.9 cm	M1	$\frac{-5 \pm \sqrt{5^2 - 4 \times 2 \times -4250}}{2 \times 2}$ oe or $\frac{-5 \pm \sqrt{34\,025}}{4}$
		A1	[44.86, 44.87]
		A1ft	34.9 or [34.86, 34.87] ft their positive $x - 10$ <i>Additional guidance:</i> Completing the square is an acceptable method: $2\left(x + \frac{5}{4}\right)^2 = 4253.125$ oe M1. Answer 44.9 (the value of x) scores M1A1A0. Answers 34.9 and -57.4 with no rejection score M1A1A0. A correct answer with no working scores 3.
Total for Question 14: 5 marks			
15	$\frac{2}{x+2}$	M1	$\frac{x^2 - 9}{2x^2 + 7x + 3} \times \frac{4x + 2}{x^2 - x - 6}$ oe (may be implied by later working)
		M1	two of $(x + 3)(x - 3)$, $(2x + 1)(x + 3)$, $(x - 3)(x + 2)$, $2(2x + 1)$ correct
		A1	$\frac{2}{x+2}$ <i>Additional guidance:</i> Accept $2(x + 2)^{-1}$. A correct answer followed by further incorrect "cancelling" (e.g. $\frac{1}{x+1}$) scores M1M1A0. $\frac{2}{x+2}$ with no working scores 3.
16	22.2°	M1	$\frac{\sin PQR}{13.5} = \frac{\sin 29}{8.4}$ oe or $\sin PQR = [0.779, 0.78]$
		M1dep	angle $PQR = 180 - \sin^{-1}\left(\frac{13.5 \sin 29}{8.4}\right)$ or [128.8, 128.82]
		A1	[22.1, 22.2] <i>Additional guidance:</i> 99.8 (using the acute angle 51.2° for PQR) scores M1M0A0. $\frac{\sin PQR}{8.4} = \frac{\sin 29}{13.5}$ (sides swapped) scores M0M0A0. Up to M2 may be awarded for correct work with no answer or an incorrect answer.
17(a)	$g(x) = 3x + 5$	B1	$3x + 5$ <i>Additional guidance:</i> Accept $a = 3$, $b = 5$. $3 - 3x$ (from $a = -3$, $b = 3$) scores B0 because $a > 0$. $3x + 1$ or $3x - 3$ scores B0.

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Q	Answer	Marks	Guidance
17(b)	$x = 1$ or $x = 7$	M1	$3(x - 4)^2 + 5 = 32$ or $3x^2 - 24x + 53 = 32$ oe (ft their linear g)
		A1	1 and 7 <i>Additional guidance:</i> $x = 7$ only scores M1A0. Using $fg(x) = 32$, i.e. $(3x + 1)^2 = 32$, scores M0A0. Ignore the method used to solve a correct equation. $3x^2 - 24x + 21 = 0$ and $(x - 1)(x - 7) = 0$ is a correct alternative.
Total for Question 17: 3 marks			
18	$x = 14$	M1	angle $OBA = 2x + 7$ or angle $OAC = 3x - 4$ or $166 - 4x$ or $188 - 6x$ (may be on the diagram)
		M1	reflex angle $BOC = 2(8x - 5)$ oe or angle $BAC = 5x + 3$ oe
		M1dep	$166 - 4x + 188 - 6x = 16x - 10$ or $5x + 3 + 8x - 5 = 180$ oe (dep on M2)
		A1	14 <i>Additional guidance:</i> Using the obtuse angle $BOC = 2(8x - 5)$, e.g. $(166 - 4x) + (188 - 6x) + (16x - 10) = 360$, gives $x = \frac{8}{3}$ and scores M1M0M0A0. Opposite angles taken as equal ($5x + 3 = 8x - 5$) scores M1M1M0A0. Up to M3 may be awarded for correct work with no answer or an incorrect answer.
19(a)	$f\left(\frac{2}{3}\right) = \frac{8}{9} + \frac{64}{9} - 14 + 6 = 0$, so $(3x - 2)$ is a factor of $f(x)$	M1	$3 \times \left(\frac{2}{3}\right)^3 + 16 \times \left(\frac{2}{3}\right)^2 - 21 \times \frac{2}{3} + 6$ oe
		A1	$\frac{8}{9} + \frac{64}{9} - 14 + 6 = 0$ oe (terms evaluated) and a conclusion, e.g. so $(3x - 2)$ is a factor <i>Additional guidance:</i> Algebraic division or comparing coefficients scores M0A0 (the question says use the factor theorem). $f\left(\frac{2}{3}\right) = 0$ with no evaluation of the terms scores M1A0.
19(b)	$x = \frac{2}{3}$, $x = -3 + 2\sqrt{3}$, $x = -3 - 2\sqrt{3}$	M1	$(3x - 2)(x^2 + bx + c)$ with two of x^2 , $6x$, -3 correct
		A1	$(3x - 2)(x^2 + 6x - 3)$
		M1	$\frac{-6 \pm \sqrt{6^2 - 4 \times 1 \times -3}}{2}$ or $(x + 3)^2 = 12$ oe (correct method for their quadratic)
		A1	$\frac{2}{3}$ and $-3 + 2\sqrt{3}$ and $-3 - 2\sqrt{3}$

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> Accept $-3 \pm 2\sqrt{3}$ for the two surd solutions. $\frac{-6 \pm \sqrt{48}}{2}$ unsimplified as the answer scores M1A1M1A0. Decimal answers (0.464 ..., -6.46 ...) score M1A1M1A0. Omitting $\frac{2}{3}$ scores M1A1M1A0. Answers from an equation solver with no quadratic factor seen score 0.
			Total for Question 19: 6 marks
20	$-0.907 < x < 2.57$	M1	expands $(x^2 - 7)(2x - 5)$ with at least three terms correct
		A1	$\frac{dy}{dx} = 6x^2 - 10x - 14$ oe
		M1	their $\frac{dy}{dx} < 0$ or $= 0$ with a correct method to solve it, e.g. $\frac{10 \pm \sqrt{(-10)^2 - 4 \times 6 \times -14}}{2 \times 6}$
		A1	$[-0.907, -0.906]$ and $[2.57, 2.574]$
		A1	$-0.907 < x < 2.57$ <i>Additional guidance:</i> Accept $\leq$ for $<$. Accept $\frac{5 - \sqrt{109}}{6} < x < \frac{5 + \sqrt{109}}{6}$ for the final two marks. $x < -0.907$ or $x > 2.57$ (where y is increasing) scores M1A1M1A1A0. $2x \times 2 = 4x$ (each bracket differentiated separately) scores M0A0. A correct derivative from another valid method scores M1A1.
21(a)	$VO = 6.4 \tan 66^\circ = 14.374 \dots = 14.4 \text{ cm (3 s.f.)}$	M1	$\tan 66 = \frac{VO}{6.4}$ or $6.4 \tan 66$ oe
		A1	$[14.37, 14.38]$ seen <i>Additional guidance:</i> Alternative: $VA = \frac{6.4}{\cos 66}$ ($[15.73, 15.74]$) then $VA \sin 66$ or Pythagoras oe M1. $6.4 \tan 66 = 14.4$ with no more accurate value scores M1A0. $6.4 \tan 24$ (2.85) scores M0A0.
21(b)	40.1°	M1	$VA = \frac{6.4}{\cos 66}$ or $\sqrt{6.4^2 + 14.37 \dots^2}$ or $[15.73, 15.76]$ oe
		M1dep	$\sin(\frac{1}{2}AVB) = \frac{5.4}{\text{their } VA}$ or $\cos AVB = \frac{2 \times \text{their } VA^2 - 10.8^2}{2 \times \text{their } VA^2}$ oe
		A1	$[39.9, 40.3]$

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> The range allows for $VO = 14.4$ or $VA = 15.7$ or 15.8 used. [20, 20.2] (half of angle AVB) as the answer scores M1M1A0. $\tan\left(\frac{1}{2}AVB\right) = \frac{5.4}{14.37\dots}$ (using VO as if it were in triangle VAB , 41.2) scores MOM0A0 unless VA is found.
			Total for Question 21: 5 marks
22	90° , 205.4° , 270° , 334.6°	M1	$\cos x (7 \sin x + 3) = 0$ oe, or $\cos x = 0$ and $\sin x = -\frac{3}{7}$
		A1	90 and 270
		M1	$\sin^{-1}\left(-\frac{3}{7}\right)$ or $\pm[25.3, 25.4]$ seen
		A1	$[205.3, 205.4]$ and $[334.6, 334.7]$, and no other values in the range <i>Additional guidance:</i> Dividing by $\cos x$ (so $\sin x = -\frac{3}{7}$ only) can score MOA0M1A1. -25.4 given as a solution scores the 2nd M1 but not the final A1. Ignore solutions outside $0^\circ \leq x \leq 360^\circ$. $\sin x = \frac{3}{7}$ (sign lost, giving 25.4 and 154.6) scores M1A1M1A0.