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CAMBRIDGE
International Education

Cambridge International AS Level

MATHEMATICS **9709/23**

Paper 2 Pure Mathematics 2 **May/June 2026**

MARK SCHEME

Maximum Mark: 50

Published

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.

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General marking principles

All examiners must apply these marking principles when marking candidate responses.

1	Examiners must award marks for each response in line with: • the specific **content** defined in the mark scheme • the specific **skills** defined in the mark scheme or in the level descriptions • the **standard of response** required as exemplified by the standardisation scripts.
2	Examiners must award **whole marks** (not half marks, or other fractions).
3	Examiners must award marks **positively**. This means that: • marks are not deducted for errors or omissions • marks are awarded for correct/valid answers as defined in the mark scheme and also for **other valid answers** which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate • the quality of spelling, punctuation and grammar are judged **only** when the mark scheme indicates that these features are **specifically assessed** in the question. However, the meaning of all responses must be unambiguous.
4	Examiners must **consistently** apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly.
5	Examiners must use the **full range of marks** defined in the mark scheme, unless limited by the quality of the candidate responses seen.
6	Examiners must award marks according to the mark scheme and **must not** award marks with grade thresholds or grade descriptions in mind.

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Mathematics-Specific Marking Principles

1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.

2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.

3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.

4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).

5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.

6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

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Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
	More information required
	Accuracy mark awarded zero
	Accuracy mark awarded one
	Independent accuracy mark awarded zero
	Independent accuracy mark awarded one
	Independent accuracy mark awarded two
	Benefit of the doubt
	Blank Page
	Incorrect
Dep	Used to indicate DM0 or DM1

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Annotation	Meaning
DM1	Dependent on the previous M1 mark(s)
FT	Follow through
	Indicate working that is right or wrong
Highlighter	Highlight a key point in the working
ISW	Ignore subsequent work
J	Judgement
JU	Judgement
M0	Method mark awarded zero
M1	Method mark awarded one
M2	Method mark awarded two
MR	Misread
O	Omission or Other solution
Off-page comment	Allows comments to be entered at the bottom of the RM marking window and then displayed when the associated question item is navigated to.
On-page comment	Allows comments to be entered in speech bubbles on the candidate response.
PE	Judgment made by the PE
Pre	Premature approximation
SC	Special case
SEEN	Indicates that work/page has been seen

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Annotation	Meaning
SF	Error in number of significant figures
	Correct
TE	Transcription error
XP	Correct answer from incorrect working

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Mark Scheme Notes

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Types of mark

M Method mark, awarded for a valid method applied to the problem. Method marks are not lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, e.g. by substituting the relevant quantities into the formula. Correct application of a formula without the formula being quoted obviously earns the M mark and in some cases an M mark can be implied from a correct answer.

A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated method mark is earned (or implied).

B Mark for a correct result or statement independent of method marks.

DM or **DB** When a part of a question has two or more 'method' steps, the M marks are generally independent unless the scheme specifically says otherwise; and similarly, when there are several B marks allocated. The notation DM or DB is used to indicate that a particular M or B mark is dependent on an earlier M or B (asterisked) mark in the scheme. When two or more steps are run together by the candidate, the earlier marks are implied and full credit is given.

FT Implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A or B marks are given for correct work only.

- A or B marks are given for correct work only (not for results obtained from incorrect working) unless follow through is allowed (see abbreviation FT above).
- For a numerical answer, allow the A or B mark if the answer is correct to 3 significant figures or would be correct to 3 significant figures if rounded (1 decimal place for angles in degrees).
- The total number of marks available for each question is shown at the bottom of the Marks column.
- Wrong or missing units in an answer should not result in loss of marks unless the guidance indicates otherwise.
- Square brackets [ ] around text or numbers show extra information not needed for the mark to be awarded.

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Abbreviations

AEF/OE	Any Equivalent Form (of answer is equally acceptable) / Or Equivalent
AG	Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)
CAO	Correct Answer Only (emphasising that no 'follow through' from a previous error is allowed)
CWO	Correct Working Only
ISW	Ignore Subsequent Working
SOI	Seen Or Implied
SC	Special Case (detailing the mark to be given for a specific wrong solution, or a case where some standard marking practice is to be varied in the light of a particular circumstance)
WWW	Without Wrong Working
AWRT	Answer Which Rounds To

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Question	Answer	Marks	Guidance
1	Expand integrand to obtain $1+2\mathrm{e}^{-x}+\mathrm{e}^{-2x}$	**B1**	
	Integrate to obtain at least two of the terms of the form $x+k_1\mathrm{e}^{-x}+k_2\mathrm{e}^{-2x}$	**M1**	
	Obtain correct $x-2\mathrm{e}^{-x}-\frac{1}{2}\mathrm{e}^{-2x}$	**A1**	
	Apply limits correctly to obtain $a-\frac{3}{2}\mathrm{e}^{-2a}-\frac{1}{2}\mathrm{e}^{-4a}+2\mathrm{e}^{-a}$	**A1**	
		4	

Question	Answer	Marks	Guidance
2	Use correct identities to produce a correct equation in one trigonometric function	**M1**	
	Obtain $\sin^2\theta=\frac{1}{3}$ or $\cos^2\theta=\frac{2}{3}$ or $\tan^2\theta=\frac{1}{2}$ or $\cot^2\theta=2$ or $\mathrm{cosec}^2\theta=3$	**A1**	
	Obtain at least two of the correct answers $\pm35.3,\ \pm144.7$	**A1**	Allow greater accuracy 35.264…, 144.735…
	Obtain all four correct answers and no others between –180° and 180°	**A1**	
		4	

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Question	Answer	Marks	Guidance
3	**Either** State or imply equation $\ln y = \ln k + (x+2)\ln a$	**B1**	
	Equate gradient of line to $\ln a$ and attempt to find value of a	**M1**	
	Obtain $\ln a = 0.588$ and hence $a = 1.8$	**A1**	
	Substitute appropriate values to find $\ln k$	**M1**	
	Obtain $\ln k = 1.162$ and hence $k = 3.2$	**A1**	
	Or State or imply equation $\ln y = \ln k + (x+2)\ln a$	**B1**	
	$3.22 = \ln k + 3.5\ln a$ and $4.69 = \ln k + 6\ln a$	***M1**	
	Obtain $\ln a = 0.588$ and hence $a = 1.8$	**A1**	
	Substitute $\ln a$ to find $\ln k$	**DM1**	
	Obtain $\ln k = 1.162$ and hence $k = 3.2$	**A1**	
	Or $e^{3.22} = ka^{3.5}$ and $e^{4.69} = ka^{6}$	***M1**	
	Eliminate either k or a correctly to find an unsimpified equation in either a or k	***DM1**	
	Obtain either $a = 1.8$ or $k = 3.2$	**A1**	

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Question	Answer	Marks	Guidance
3	Substitute either a or k to find either k or a	**DDM1**	
	Obtain either $k = 3.2$ or $a = 1.8$	**A1**	
		5	

Question	Answer	Marks	Guidance
4	Attempt use of correct quotient rule	***M1**	OE
	Obtain $\frac{dy}{dx} = \frac{e^{3x} + 4e^{2x}}{(e^x + 2)^2}$	**A1**	Or (unsimplified) equivalent.
	Substitute $x = 0$ to find value of derivative at P	**DM1**	
	Obtain $-\frac{9}{5}$ for gradient of normal	**A1**	From correct expression for derivative,
	Use $x = 0$, $y = \frac{1}{3}$ and *their* negative reciprocal of derivative to find equation	**M1**	
	Obtain $27x + 15y - 5 = 0$ or equivalent of requested form	**A1**	From correct work only, Must have integer coefficients and be equated to zero,
		6	

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Question	Answer	Marks	Guidance
5(a)	**Either** Solve $4x-7=2x+3$ to obtain $x=5$	**B1**	Or inequality using < or $\leqslant$.
	Attempt solution of linear equation where $4x$ and $2x$ have different signs	**M1**	Or inequality using < or $\leqslant$.
	Obtain $x=\frac{2}{3}$ or $x=\frac{4}{6}$	**A1**	
	Conclude $\frac{2}{3}\leqslant x\leqslant 5$ or $x\leqslant 5$ **and** $x\geqslant\frac{2}{3}$	**A1**	Now using $\leqslant$ signs.
	Or State or imply non-modular equation $(4x-7)^2=(2x+3)^2$	**B1**	Or inequality using < or $\leqslant$.
	Attempt solution of three-term quadratic equation or inequality	**M1**	$12x^2-68x+40=0$
	Obtain critical values $\frac{2}{3}$ and 5	**A1**	
	Conclude $\frac{2}{3}\leqslant x\leqslant 5$ or $x\leqslant 5$ **and** $x\geqslant\frac{2}{3}$	**A1**	Now using $\leqslant$ signs.
		4	
5(b)	Attempt solution for N of $\ln\left(\frac{1}{2}N\right)$ equated to either critical value from **5(a)**	**M1**	Allow non-integer value for N so far. Must be using a correct method.
	Obtain $\ln\left(\frac{1}{2}N\right)=\frac{2}{3}$ and hence smallest integer is 4	**A1**	Allow if seen as part of an inequality.
	Obtain $\ln\left(\frac{1}{2}N\right)=5$ and hence largest integer is 296	**A1**	Allow if seen as part of an inequality.
		3	

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Question	Answer	Marks	Guidance
6(a)	Attempt solution for a of $f(-2)=0$	**M1**	
	Obtain $16a-32-12a+42-18=0$ and hence $a=2$	**A1**	
		2	
6(b)	Attempt division of quartic with their a to obtain quotient at least as far as the x term	**M1**	Or by inspection, …
	Obtain $2x^3-6x-9$	**A1**	
	Rearrange $2x^3-6x-9=0$ to confirm $x=\sqrt[3]{3x+4.5}$	**A1**	AG – necessary detail needed.
		3	
6(c)	Use iteration process correctly at least once	**M1**	
	Obtain final answer 2.238	**A1**	Answer required to exactly four significant figures
	Show sufficient iterates to 6 significant figures to justify answer or show a sign change in the interval [2.2375, 2.2385]	**A1**	
		3	

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Question	Answer	Marks	Guidance
7	Attempt to find solution of $8\cos 2x - \dfrac{1}{\cos^2 2x} = 0$	**M1**	
	Obtain $\cos 2x = \frac{1}{2}$ and hence $x = \pm\frac{1}{6}\pi$	**A1**	
	Recognise $\dfrac{1}{\cos^2 2x}$ as $\sec^2 2x$	**B1**	
	Integrate to obtain the form $k_1 \sin 2x + k_2 \tan 2x$	***M1**	
	Obtain correct $4\sin 2x - \frac{1}{2}\tan 2x$	**A1**	
	Apply correct method for their limits to find exact value	**DM1**	Or using 0 and *their* positive value together with doubling the result, but not for two positive values.
	Obtain $3\sqrt{3}$	**A1**	Or exact equivalent.
		7	

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Question	Answer	Marks	Guidance
8(a)	Obtain $\frac{\mathrm{d}x}{\mathrm{d}t} = 6 - 2\cos 2t$	**B1**	
	Obtain $\frac{\mathrm{d}y}{\mathrm{d}t} = -6\sin 2t + 5\cos t$	**B1**	
	Attempt value of $\frac{\mathrm{d}y}{\mathrm{d}x}$ for $t = 0$	**M1**	
	Obtain $\frac{5}{4}$	**A1**	OE
		4	
8(b)	Equate $\frac{\mathrm{d}y}{\mathrm{d}x}$ or $\frac{\mathrm{d}y}{\mathrm{d}t}$ to zero and use identity $\sin 2t = 2\sin t\cos t$	**M1**	
	Obtain $\cos t(5 - 12\sin t) = 0$ or equivalent and hence at least $\sin t = \frac{5}{12}$	**A1**	
	Attempt to express y in terms of $\sin t$ and/or $\cos t$ only	**M1**	
	Obtain $3 - 6\sin^2 t + 5\sin t$ or $3\left(\cos^2 t - \sin^2 t\right) + 5\sin t$ **and** $\cos t = \frac{\sqrt{119}}{12}$ $3\left(2\cos^2 t - 1\right) + 5\sin t$ **and** $\cos t = \frac{\sqrt{119}}{12}$	**A1**	
	Substitute exact value of $\sin t$ and $\cos t$ (if appropriate) to obtain $\frac{97}{24}$	**A1**	Or exact equivalent.
		5	

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