CAMBRIDGE
International Education

Cambridge O Level

ADDITIONAL MATHEMATICS **4037/23**

Paper 2 **October/November 2025**

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **15** printed pages.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors 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
A0	Accuracy mark awarded zero
A1	Accuracy mark awarded one
A2	Accuracy mark awarded two
A3	Accuracy mark awarded three
B0	Independent mark awarded zero
B1	Independent mark awarded one
B2	Independent mark awarded two
B3	Independent mark awarded three
BOD	Benefit of the doubt
C	Communication mark
✗	Incorrect
FT	Follow through
Highlighter	Highlight a key point in the working
ISW	Ignore subsequent work
M0	Method mark awarded zero
M1	Method mark awarded one
M2	Method mark awarded two
M3	Method mark awarded three

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Annotation	Meaning
MR	Misread
O	Omission
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.
Pre	Premature rounding/approximation
SC	Special case
SEEN	Indicates that work/page has been seen
TE	Transcription error
✔	Correct
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 marks, awarded for a valid method applied to the problem.

A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be earned or implied.

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

When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. The notation 'dep' is used to indicate that a particular M or B mark is dependent on an earlier mark in the scheme.

Abbreviations

awrt	answers which round to
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
nfww	not from wrong working
oe	or equivalent
rot	rounded or truncated
SC	Special Case
soi	seen or implied

Question	Answer	Marks	Guidance
1	$27a - 63 - 3b + 9 = 0$ oe	**B1**	
	$-8a - 28 + 2b + 9 = -35$ oe	**B1**	
	Eliminates one unknown and solves for a or b	**M1**	**FT** *their* equations provided both equations are linear with terms in a and b
	$a = 2$, $b = 0$ nfww	**A2**	**A1** for each

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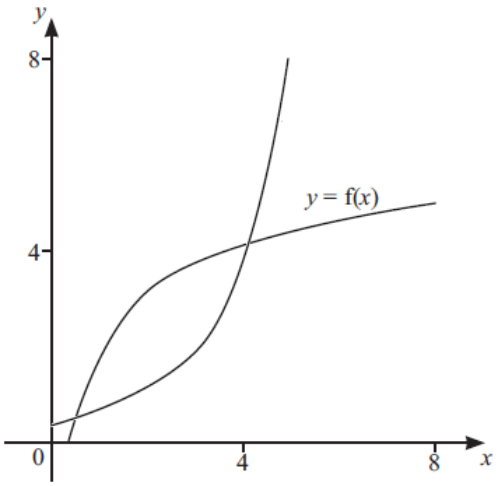
Question	Answer	Marks	Guidance
2(a)(i)		**B1**	• Correct inverse function drawn with correct shape over correct domain and range • 2nd intersection at roughly (4, 4)
2(a)(ii)	Reflection in $y = x$ oe	**B1**	
2(b)(i)	Complete method including change of subject and swop of variables at some point	**M2**	**M1** for $\ln y = \sqrt{x-2}$ or $\ln x = \sqrt{y-2}$ soi
	$\left[g^{-1}(x) =\right] (\ln x)^2 + 2$	**A1**	Final answer
2(b)(ii)	$g^{-1}(x) \geqslant 2$	**B1**	
2(b)(iii)	$e^{\frac{1}{x}}$ or $\sqrt[x]{e}$ or $e^{x^{-1}}$	**B2**	Final answer **B1** for $e^{\sqrt{\frac{1}{x^2}+2-2}}$ soi oe
3(a)(i)	$\left(x-\frac{1}{2}\right)^2 - \frac{25}{4}$ oe isw	**B2**	**B1** for $\left(x-\frac{1}{2}\right)^2$ or for $(x+a)^2 - \frac{25}{4}$ OR **B1** for $a = -\frac{1}{2}, b = -\frac{25}{4}$ stated
3(a)(ii)	$(-their\ a,\ their\ b)$ oe	**B2**	**STRICT FT** from **part (i)** **B1 STRICT FT** for x-coordinate = $-their\ a$ or for y-coordinate = $their\ b$

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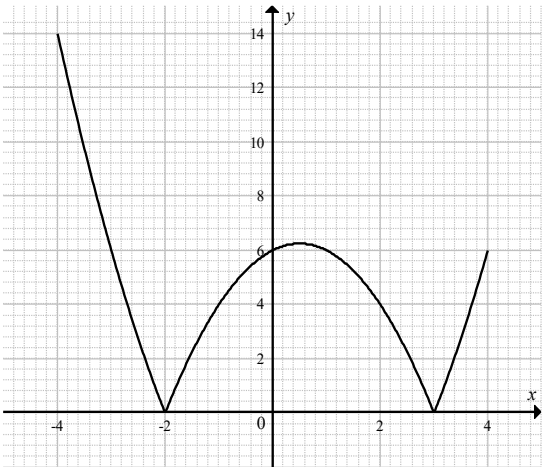
Question	Answer	Marks	Guidance
3(b)	Correct graph  	**B3**	**B2** for correct shape with cusps and intercepts at (–2, 0), (3, 0) and (0, 6) and maximum in 1st quadrant or **B1** for correct shape with cusps on x-axis and incorrect intercepts or **B1** for correct shape with no cusps (e.g. having minima) **and** intercepts at (–2, 0), (3, 0) and at (0, 6)
3(c)	*their* $-2.7 < x < -1$, $2 < x <$ *their* 3.7	**B2**	**STRICT FTB2 dep** on a graph **with correct intercepts** earning at least **B1** in **part (b)** **and** their curve crossing $y = 4$ in four places **STRICT FTB1** for either '*their* $-2.7 < x < -1$' or '$2 < x <$ *their* 3.7' OR **B1 FT** for *their* 4 critical values providing at least **B1** awarded for **part (b)** soi
4(a)(i)	$\frac{1}{5}e^{5x-2}(+c)$	**2**	**B1** for ke^{5x-2} where k is a non-zero constant
4(a)(ii)	$-\frac{1}{3}\ln(4-3x)(+c)$	**2**	**B1** for $-\frac{1}{3}\ln 4-3x$ or $kln(4-3x)$ where k is a non-zero constant
4(b)	$2\tan\left(\frac{1}{2}x\right)$	**M2**	**M1** for $k\tan\left(\frac{1}{2}x\right)$ where k is a non-zero constant
	Fully justified completion to given answer e.g. $2\tan\frac{\pi}{4}-2\tan\frac{\pi}{6}=2\left(1-\frac{\sqrt{3}}{3}\right)$	**A1**	Or $2(\tan\frac{\pi}{4}-\tan\frac{\pi}{6})=2\left(1-\frac{\sqrt{3}}{3}\right)$
5(a)	60 480 Final answer	**B1**	

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Question	Answer	Marks	Guidance
5(b)	20 160 Final answer	**2**	**M1** for $3\times{}^{8}P_5$ or $3\times8\times7\times6\times5\times4$ or $\frac{1}{3}\times{}^{9}P_6$ oe
5(c)	16 800 Final answer	**3**	**M1** for starts 7 then 5 or 6 or 8 or 9: 3360 **M1** for starts 8, 9: 13 440 OR **M2** *their*(**b**) – 3360 or **M1** for starts 7 then 1 or 2 or 3 or 4: 3360
6	$3x+4=2x^2+8x+1$ oe	**M1**	Eliminates one unknown
	$2x^2+5x-3[=0]$ or $-2x^2-5x+3\ [=0]$	**A1**	Writes in solvable form
	$(2x-1)(x+3)$ or $(-2x+1)(x+3)$ oe	**M1**	Uses quadratic formula or factorises *their* 3-term quadratic
	$\left(\frac{1}{2}, \frac{11}{2}\right)$ $(-3, -5)$ oe	**A1**	
	Equation of *their* perpendicular bisector: $y-\frac{1}{4}=-\frac{1}{3}\left(x+\frac{5}{4}\right)$ or $y=-\frac{1}{3}x-\frac{1}{6}$ oe	**M3**	**FT** *their* midpoint and perpendicular gradient from correct use of *their*(0.5, 5.5) and *their* (−3, −5) **M1 FT** for midpoint: (−1.25, 0.25) or $\left(\frac{their0.5+their(-3)}{2}, \frac{their5.5+their(-5)}{2}\right)$ **M1 FT** for perpendicular gradient: $m_{\perp}=\frac{-1}{\frac{their(-5)-their5.5}{their(-3)-their0.5}}$ oe or $-\frac{1}{3}$ OR **M1 FT** for equating lengths $(x+3)^2+(y+5)^2=(x-0.5)^2+(y-5.5)^2$ **M1 FT** for expanding soi $x^2+y^2+6x+10y+34=$ $x^2+y^2-x-11y+30.5$

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Question	Answer	Marks	Guidance
6	$2x + 6y + 1 = 0$ final answer	**A2**	**A1** for correct equation in a different form isw e.g. $y-\frac{1}{4}=-\frac{1}{3}\left(x+\frac{5}{4}\right)$ or $y=-\frac{1}{3}x-\frac{1}{6}$ or $\frac{y-0.25}{x+1.25}=-\frac{7}{21}$ or $x+3y+\frac{1}{2}=0$ or $2x + 6y = -1$ oe OR **A1 FT** *their* perpendicular bisector for a final answer in the form $ax+by+c=0$ **Dep** on previous **M1 M1 and** an attempt to find the perpendicular bisector
7	$(1+\tan^2 3x)+\tan 3x-3\ [=0]$	**M1**	Uses $\sec^2 3x = 1+\tan^2 3x$
	$\tan^2 3x+\tan 3x-2\ [=0]$	**A1**	Writes in solvable form
	$(\tan 3x + 2)(\tan 3x - 1)\ [= 0]$ $\tan 3x = -2$, $\tan 3x = 1$	**M1**	Factorises or solves their 3-term quadratic in $\tan 3x$
	Correct triple angle: $3x = 116.6$ or 296.6 or 45 or 225	**A1**	
	[x =] 15, 75, 38.9 or 38.85[5…] 98.9 or 98.85[5…] and no extras in range $0 \leqslant x \leqslant 120$	**A2**	**A1** for any two correct angles, ignoring extras in range

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Question	Answer	Marks	Guidance
8(a)	$\frac{\pi}{3}$	**2**	**M1** for angle AOB: $\frac{2\pi}{3}$ or angle AQO: $\frac{\pi}{6}$ or angle OAB: $\frac{\pi}{6}$ or e.g. $\cos(AOB) = -\frac{1}{2}$ or $\sin\left(\frac{1}{2}AOB\right) = \frac{\sqrt{3}}{2}$ or AQ or $BQ = 2\sqrt{3}$ If 0 scored, **SC1** for answer of 1.047 rads

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>8(b)</td><td>$2\sqrt{3}-\frac{2\pi}{3}$ or $\frac{6\sqrt{3}-2\pi}{3}$ oe nfww</td><td>6</td><td>B5 correct calculation that simplifies to give shaded area e.g. $\left(\frac{4\pi}{3}-\sqrt{3}\right)-\left(2\pi-3\sqrt{3}\right)$
OR
B1 for sector AOB: $\frac{1}{2}\times 2^2\times\frac{2\pi}{3}$ oe
B1 for ΔAOB or ΔAOQ or ΔBOQ: $\frac{1}{2}\times 2^2\times\sin\frac{2\pi}{3}$
or $\frac{1}{2}\times 2\times 2\sqrt{3}\sin\frac{\pi}{6}$ oe
B1 for sector AQB: $\frac{1}{2}\times\left(2\sqrt{3}\right)^2\times\frac{\pi}{3}$ oe
B1 for ΔAQB: $\frac{1}{2}\left(2\sqrt{3}\right)^2\sin\frac{\pi}{3}$ oe
OR
B2 FT their exact angles for a correct calculation for any two of these areas
OR
B2 for sector AOB: 4.188; ΔAOB or ΔAOQ or ΔBOQ: 1.732; sector AQB: 6.282; ΔAQB: 5.195[5] from using 1.047 rads
OR
B1FT their exact angles for a correct calculation for any one of these areas
OR
B1 for one of these areas using 1.047 rads</td></tr>
<tr><td>9(a)</td><td>Points plotted at
<table><tr><td>lnx</td><td>–0.5</td><td>1.5</td><td>2.5</td><td>3.5</td></tr><tr><td>lny</td><td>0.5</td><td>1.5</td><td>2</td><td>2.5</td></tr></table>soi
and single, ruled, straight line of best fit drawn</td><td>B2</td><td>B1 for at least 3 correctly plotted points</td></tr>
</table>

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Question	Answer	Marks	Guidance
9(b)	Uses linear points to find b = awrt 0.50 soi	**2**	**M1** for $b = \dfrac{2.5-0.5}{3.5+0.5}$ or $b = \dfrac{2.5-2}{3.5-2.5}$ oe OR **M1** for $0.5 = -0.5b + c$ oe **and** $2.5 = 3.5b + c$ oe **and** correctly eliminates c. If 0 scored, **SC1** for b = awrt 0.50 from use of given exponential equation
	Uses linear points to find $A = e^{0.7 \text{ to } 0.8}$ or 2.01 to 2.23 isw soi	**2**	**M1** for $\ln A = 0.75$ If 0 scored, **SC1** for A = 2.12 or 2.117[00…] or $e^{0.75}$ from use of given exponential equation
10(a)	Differentiates $\sqrt{2t^2+100}$: $\frac{1}{2}\left(2t^2+100\right)^{-\frac{1}{2}} \times 4t$ oe or differentiates $(2t^2+100)^{-\frac{1}{2}}$: $\left(-\frac{1}{2}\right)\left(2t^2+100\right)^{-\frac{3}{2}} \times 4t$	**B2**	**B1** for $\frac{1}{2}\left(2t^2+100\right)^{-\frac{1}{2}} \times \mathrm{f}(t)$ OR for $\left(-\frac{1}{2}\right)\left(2t^2+100\right)^{-\frac{3}{2}} \times \mathrm{f}(t)$ where f(t) is a function of t
	Correct structure of the quotient rule: $\dfrac{\left(\sqrt{2t^2+100}\right)(10)-(10t+100)\left(\frac{1}{2}\left(2t^2+100\right)^{-\frac{1}{2}} \times 4t\right)}{\left(\sqrt{2t^2+100}\right)^2}$ OR Correct structure of product rule applied to $(10t+100)(2t^2+100)^{-\frac{1}{2}}$: $(10t+100)\left(-\frac{1}{2}\left(2t^2+100\right)^{-\frac{3}{2}} \times 4t\right) + 10\,(2t^2+100)^{-\frac{1}{2}}$	**M1**	**FT** *their* $\frac{\mathrm{d}}{\mathrm{d}x}\left(\sqrt{2t^2+100}\right)$ or *their* $\frac{\mathrm{d}}{\mathrm{d}x}\left(\left(2t^2+100\right)^{-\frac{1}{2}}\right)$ as appropriate

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Question	Answer	Marks	Guidance
10(a)	Correct $\frac{ds}{dt}$: $\frac{\left(\sqrt{2t^2+100}\right)(10)-(10t+100)\left(\frac{1}{2}\left(2t^2+100\right)^{-\frac{1}{2}}\times 4t\right)}{\left(\sqrt{2t^2+100}\right)^2}$ oe , isw OR $(10t+100)\left(-\frac{1}{2}\left(2t^2+100\right)^{-\frac{3}{2}}\times 4t\right)$ $+\ 10\,(2t^2+100)^{-0.5}$ oe , isw	**A1**	
	Equates *their* $\frac{ds}{dt}$ to 0	**M1**	**Dep** on previous **M1**
	$t = 5$ nfww	**A1**	**Dep** on all previous marks **and** sight of e.g. $10\left(2t^2+100\right)-2t(10t+100)[=0]$ or $1000 - 200t$ [= 0] or $2t^2+100=\frac{1}{5}t(10t+100)$
10(b)(i)	$2\left(\sqrt{150}-10\right)$oe, isw or 4.49 or 4.494 to 4.495	**B2**	Final answer **B1** for $t = 0$, $s = 10$ **and** $t = 5$, $s = \sqrt{150}$ or $5\sqrt{6}$ or 12.24[74] soi
10(b)(ii)	$\frac{10t+100}{\sqrt{2t^2+100}}$ = *their* 10	**M1**	**FT** *their* 10 providing it is positive and greater than *their* 5
	$(10t+100)^2=(10)^2\left(2t^2+100\right)$	**M1**	**FT** *their*10 **Dep** on previous **M1**
	$T = 20$	**A1**	

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Question	Answer	Marks	Guidance
11	Radius: 5 soi	**B1**	Implied by $r^2 = 25$ or 25 used as r^2 in *their* 2nd circle equation
	Centre: $\left(4\sqrt{2}, 4\sqrt{2}\right)$ soi oe	**B2**	**B1** for (5.66, 5.66) or better OR **B1** for distance between centres is 8 soi
	$\left(x-\frac{8}{\sqrt{2}}\right)^2+\left(y-\frac{8}{\sqrt{2}}\right)^2 = 25$ oe or $x^2+y^2-2\left(4\sqrt{2}\right)x-2\left(4\sqrt{2}\right)y+2\left(4\sqrt{2}\right)^2-25=0$ oe	**M1**	**FT** $their\left(4\sqrt{2}, 4\sqrt{2}\right)$ in form (k, k) where k is a non-zero constant e.g. $\left(x-their\frac{8}{\sqrt{2}}\right)^2+\left(y-their\frac{8}{\sqrt{2}}\right)^2 = 25$ or $x^2+y^2-2theirx-theiry$ $+2(their)^2-25=0$ oe
	$x^2+y^2-8\sqrt{2}x-8\sqrt{2}y+39=0$	**A1**	Must be exact

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