CAMBRIDGE
International Education

Cambridge O Level

ADDITIONAL MATHEMATICS **4037/12**

Paper 1 **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 **14** printed pages.

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.

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.

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

Annotation	Meaning
M3	Method mark awarded three
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

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.

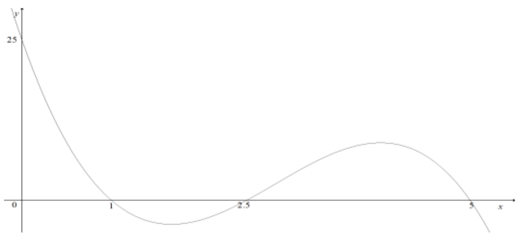
A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be earned or implied.

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

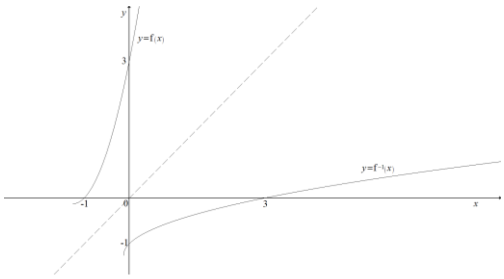
When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. The notation 'dep' is used to indicate that a particular M or B mark is dependent on an earlier mark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

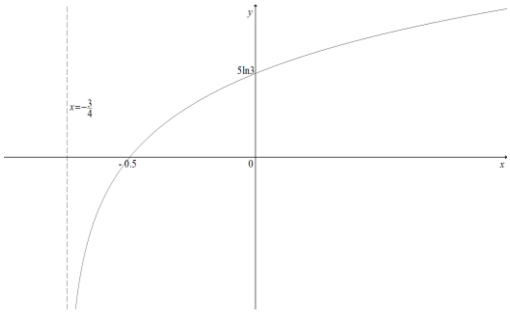
Question	Answer	Marks	Guidance
1(a)		3	**B1** for the correct shape with a distinct minimum in 4th quadrant and a distinct maximum in the first quadrant. No turning over at end points, suggesting further stationary points. **B1** for 1, 2.5 and 5 on the *x*-axis or stated. Independent mark for critical values seen correctly marked on the *x*-axis or stated with **no contradiction** and no other critical *x*-values **B1** for 25 marked correctly on the *y*-axis or stated with **no contradiction**. Independent mark.

Question	Answer	Marks	Guidance
1(b)	$1 \leqslant x \leqslant 2.5$	**B1**	Mark final answer
	$x \geqslant 5$	**B1**	Mark final answer
2(a)	$(\text{p}(-2)=)\ -16+4a-26+b=0$	**B1**	
	$(\text{p}(-1)=)\ -2+a-13+b=6$	**B1**	
	$a=7,\ b=14$	**2**	**M1** to solve *their* equations to obtain at least one value, must be using $\text{p}(-2)$ or $\text{p}(-1)$
2(b)	$(x+2)(2x^2+3x+7)=0$ soi	**2**	**M1** for attempt to factorise or use of long division on *their* $\text{p}(x)$
	Correct use of discriminant on *their* quadratic factor or correct attempt to solve *their* quadratic factor equated to zero with valid conclusion	**B1**	**FT** on *their* quadratic factor. Quadratic factor must have a negative discriminant and have a correct value if evaluated
3(a)	$a+ar=9$ or $\dfrac{a(1-r^2)}{1-r}=9$ or $\dfrac{a(r^2-1)}{r-1}=9$	**B1**	
	$\dfrac{a}{1-r}=25$	**B1**	
	$r^2=\dfrac{16}{25}$	**B1**	**Dep B** mark on both previous **B** marks
	$r=\pm\dfrac{4}{5}$ or ± 0.8	**B1**	**Dep B1** mark on all previous **B** marks
3(b)	$a=5,\ 45$	**2**	**B1** for each
4(a)	$2\left(x+\dfrac{5}{4}\right)^2-\dfrac{1}{8}$	**2**	**B1** for $2\left(x+\dfrac{5}{4}\right)^2$ **B1** for $-\dfrac{1}{8}$
4(b)	$\left(-\dfrac{5}{4},\ -\dfrac{1}{8}\right)$	**2**	**B1FT** on *their* – *a* **B1FT** on *their b* **B0** if calculus used as question says 'Hence'
4(c)(i)	$-\dfrac{5}{4}$ or $p=-\dfrac{5}{4}$ or $x \geqslant -\dfrac{5}{4}$	**B1**	**FT** on *their* – *a* from part **(a)**. Allow if from calculus

Question	Answer	Marks	Guidance
4(c)(ii)		**5**	**B1** for $y = \mathrm{f}(x)$ drawn as a one-one function in the first, second and third quadrants or first and second quadrants. Must have correct curvature **Dep B1** for $y = \mathrm{f}^{-1}(x)$ as a reflection of *their* $y = \mathrm{f}(x)$ in the line $y = x$. Maybe implied by intercepts, but must have the correct curvature **B1** for $y = \mathrm{f}(x)$ clearly passing through $x = -1$ correctly soi. Allow if domain is unrestricted but must have correct quadratic shape or curvature **B1** for $y = \mathrm{f}(x)$ passing through $y = 3$ only on the y-axis soi. Allow if domain is unrestricted but must have correct quadratic shape or curvature **B1** for – 1 and 3 marked correctly for $y = \mathrm{f}^{-1}(x)$ allow for unrestricted range. Must have correct curvature.
5(a)	$\lg\left(\frac{a^5}{1000b^4}\right)$ or $\lg\left(\frac{a^5}{10^3 b^4}\right)$ or $\lg\left(10^{-3}a^5b^{-4}\right)$ or $\lg\left(0.001a^5b^{-4}\right)$ or $\lg\left(\frac{a^5b^{-4}}{10^3}\right)$ or equivalent correct single logarithm to base 10.	**3**	**B2** for $\lg\left(a^5 \div b^4 \div 1000\right)$ **or B2** for $\lg\left(\frac{a^5}{b^4} \div 1000\right)$ **B1** for $3 = \lg 1000$ or $\lg 10^3$ soi **B1** for use of the power rule at least once

Question	Answer	Marks	Guidance
5(b)	$\log_5(x+1) - \dfrac{1}{\log_5(x+1)} = 0$ oe	B1	For change of base seen in the equation, allow for $\log_5(x+1) - \dfrac{\log_5 5}{\log_5(x+1)} = 0$
	$(\log_5(x+1))^2 = 1$ leading to $\log_5(x+1) = [\pm]1$	M1	For correct simplification to a 2-term quadratic and at least one solution, may be implied by a substitution
	$x = 4$	A1	**SC B1** if 'spotted' from a correct equation
	$x = -\dfrac{4}{5}$	A1	**A0** if rejected or crossed out
	Alternative method 1		
	$\log_{x+1} 5 - \dfrac{1}{\log_{x+1} 5} = 0$ oe	(B1)	For change of base seen in the equation, allow for $\log_{x+1} 5 - \dfrac{\log_{x+1}(x+1)}{\log_{x+1} 5} = 0$
	$(\log_{x+1} 5)^2 = 1$ $\log_{x+1} 5 = [\pm]1$	(M1)	For correct simplification to a 2-term quadratic and at least one solution, may be implied by a substitution.
	$x = 4$	(A1)	
	$x = -\dfrac{4}{5}$	(A1)	**A0** if rejected or crossed out
	Alternative method 2		
	$\dfrac{\lg(x+1)}{\lg 5} - \dfrac{\lg 5}{\lg(x+1)} = 0$ oe	(B1)	For change of base seen in the equation, allow for $\lg(x+1) - \dfrac{\lg 10}{\lg(x+1)} = 0$
	$(\lg(x+1))^2 = (\lg 5)^2$ leading to $\lg(x+1) = [\pm]\lg 5$	(M1)	For correct simplification to a 2-term quadratic and at least one solution, may be implied by a substitution
	$x = 4$	(A1)	**SC B1** if 'spotted' from a correct equation
	$x = -\dfrac{4}{5}$	(A1)	**A0** if rejected or crossed out

Question	Answer	Marks	Guidance
6	$2x^2 + x - 10 = 5$ leading to $2x^2 + x - 15 = 0$ with a valid attempt to solve to obtain 2 values for x	**M1**	
	$x = \frac{5}{2}, \ -3$	**A1**	For both Mark final answer for this equation, **A0** if – 3 is rejected
	$2x^2 + x - 10 = -5$ leading to $2x^2 + x - 5 = 0$	**M1**	Must be a correct 3-term quadratic equated to zero
	$x = \frac{-1 \pm \sqrt{41}}{4}$ oe	**2**	**Dep M1** for a valid method of solution to obtain 2 values for x. Mark final answer for this equation, **A0** if negative root is rejected Denominator of final answer must be positive
7(a)	Grad $AB = \frac{6}{8}$ oe Grad $AC = -\frac{2}{14}$ oe Grad $BC = -\frac{8}{6}$ oe	**2**	**B1** for 2 correct unsimplified
7(b)	Centre $(5, 3)$	**B1**	**FT** on *their* diameter, allow for $(2, 7)$ or $(9, 6)$
	Radius^2 = 50 oe soi	**2**	**M1** for use of *their* centre and coordinates of either A, B or C to find the square of the radius or the radius. Centre must not be A, B or C. or Finding the length between any 2 points A, B or C **and** halving it.
	$(x-5)^2 + (y-3)^2 = 50$ oe	**A1**	Allow $(5\sqrt{2})^2$ for radius^2

Question	Answer	Marks	Guidance
8		4	**B1** for correct shape in first three quadrants tending towards a vertical asymptote in the second and third quadrants. **Dep B1** for curve passing through $x = -0.5$ oe on the x-axis , or stated and no other points on the x-axis **Dep B1** for curve passing through $y = 5\ln 3$ oe on the y-axis , or stated and no other points on the y-axis **B1** for $x = -\frac{3}{4}$ oe shown on graph or stated as the equation of the asymptote. May be implied by a dotted or straight vertical line through $x = -\frac{3}{4}$. This is not a dependent mark.

Question	Answer	Marks	Guidance
9(a)	$f'(x) = -(2x+5)^{-\frac{1}{2}}$ $(+c)$	2	**M1** for $k(2x+5)^{-\frac{1}{2}}$ Allow unsimplified for **A1**
	$f'(x) = -(2x+5)^{-\frac{1}{2}} + 1$ soi	2	**Dep M1** for use of $f'(x) = \frac{2}{3}$ and $x = 2$ in *their* $f'(x)$ in the form $k(2x+5)^{-\frac{1}{2}} + c$. Allow term in $(2x+5)^{-\frac{1}{2}}$ unsimplified. Need to see attempt at substitution.
	$f(x) = x - (2x+5)^{\frac{1}{2}}$ $(+d)$	2	**M1** for $p(2x+5)^{\frac{1}{2}}$
	$f(x) = x - (2x+5)^{\frac{1}{2}} + 3$ soi	2	**Dep M1** for use of $x = 2$ and $y = 2$ in *their* $f(x)$ in the form $rx + p(2x+5)^{\frac{1}{2}} + d$. Allow term in $(2x+5)^{\frac{1}{2}}$ unsimplified. Need to see an attempt at substitution.
	When $f'(x) = 0$, $x = -2$	2	**M1** for solution of *their* $f'(x) = 0$, must be in the form $p(2x+5)^{-\frac{1}{2}} + q$ to obtain a value for *x*.
	$y = 0$	**A1**	
9(b)	$f''(-2) = 1$ [so positive] $\therefore$ a min point or correct use of first derivative test considering *x* values greater than $-\frac{5}{2}$	**B1**	Need to see evidence of substitution for either test. **B0** if $x = -2$ obtained incorrectly in part **(a)**
10	$(\sin\theta + \cos\theta)^2 + (\sin\theta - \cos\theta)^2 = 2$	2	**M1** for expansion of both terms with an attempt to simplify either using the correct identity or eliminating terms in $2\sin\theta\cos\theta$
	$\int 2 \, d\theta = 2\theta$	**M1**	**Dep M1**
	$\int_{\frac{\pi}{2}}^{\frac{3\pi}{2}} 2 \, d\theta = 3\pi - \pi$ $= 2\pi$	2	**Dep M1** for correct use of limits

Question	Answer	Marks	Guidance
11	$\frac{(n-4)(n+1)!}{(n-4)!5!} = \frac{(n+2)!}{(n-5)!7!}$ leading to $7 \times 6 = n+2$	2	**B1** for 7×6 or 42 seen as a result of simplification of the numerical factorials **B1** for $n+2$ seen as a result of simplification of the algebraic factorials
	$n = 40$	**B1**	
12(a)	$\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{(x-2)2x\mathrm{e}^{x^2} - \mathrm{e}^{x^2}}{(x-2)^2}$ or $\frac{\mathrm{d}y}{\mathrm{d}x} = 2x\mathrm{e}^{x^2}(x-2)^{-1} - \mathrm{e}^{x^2}(x-2)^{-2}$	3	**B1** for $2x\mathrm{e}^{x^2}$ **M1** for differentiation of a quotient or equivalent correct product **A1** all other terms correct
	$-\frac{1}{4}$	**A1**	Must be from correct working
12(b)	For use of $\frac{\mathrm{d}y}{\mathrm{d}x} \times \frac{\mathrm{d}x}{\mathrm{d}t} = \frac{\mathrm{d}y}{\mathrm{d}t}$	**M1**	**FT** on $0.5 \times \frac{1}{\textit{their}\left(-\frac{1}{4}\right)}$
	–2	**A1**	Must be from correct working in part **(a)**

Question	Answer	Marks	Guidance
13	$\sin\theta = \frac{2-x}{3}$	**B1**	
	$y = 3\left(\frac{\cos^2\theta}{\sin^2\theta}\right)$ soi	**B1**	
	Use of $\sin^2\theta + \cos^2\theta = 1$ to obtain $y = 3\left(\frac{1-\left(\frac{2-x}{3}\right)^2}{\left(\frac{2-x}{3}\right)^2}\right)$	**B1**	**Dep** on both previous **B** marks
	$y = 3\left(\left(\frac{3}{(2-x)}\right)^2 - 1\right)$ oe	**B1**	**Dep** on all previous **B** marks No fractions within fractions
	Alternative method 1		
	$\operatorname{cosec}\theta = \frac{3}{2-x}$	**(B1)**	
	$\cot^2\theta = \frac{y}{3}$	**(B1)**	
	Use of $\cot^2\theta + 1 = \operatorname{cosec}^2\theta$ to obtain $\frac{y}{3} + 1 = \frac{9}{(2-x)^2}$	**(B1)**	**Dep** on both previous **B** marks
	$y = 3\left(\frac{9}{(2-x)^2} - 1\right)$ oe	**(B1)**	**Dep** on all previous **B** marks No fractions within fractions
	Alternative method 2		
	$y = 3(\operatorname{cosec}^2\theta - 1)$ or $\frac{y}{3} = \operatorname{cosec}^2\theta - 1$ soi	**(B1)**	
	$\operatorname{cosec}^2\theta = \frac{1}{\sin^2\theta}$ soi	**(B1)**	
	$\sin\theta = \frac{2-x}{3}$	**(B1)**	
	$y = 3\left(\frac{9}{(2-x)^2} - 1\right)$ oe	**(B1)**	**Dep** on all previous **B** marks No fractions within fractions