Cambridge Assessment International Education

Cambridge IGCSE™

ADDITIONAL MATHEMATICS **0606/01**

Paper 1 Non-calculator **For examination from 2025**

MARK SCHEME B

Maximum Mark: 80

Specimen

This document has **10** 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 descriptions for the question • the specific skills defined in the mark scheme or in the generic level descriptions 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 descriptions.
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 descriptions 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 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.

MARK SCHEME NOTES

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

Anything in the mark scheme which is in square brackets […] is not required for the mark to be earned, but if present it must be correct.

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.

Types of mark

M Method mark, awarded for a valid method applied to the problem.

A Accuracy mark, given 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.

Abbreviations

awrt	answers which round to
cao	correct answer only
dep	dependent on the previous mark(s)
FT	follow through after error
isw	ignore subsequent working (after correct answer obtained)
nfww	not from wrong working
oe	or equivalent
rot	rounded or truncated
SC	special case
soi	seen or implied

Question	Answer	Marks	Partial Marks
1	$a = 2$	**B1**	Allow embedded
	$b = 3$	**B1**	
	$c = -4$	**B1**	
2	$5x + 2 = 3x - 4$ $x = -3$	**B1**	
	$5x + 2 = -3x + 4$ $x = \frac{1}{4}$	**2**	**M1** for change of sign
	$\left\|2\left(\frac{1}{4}\right) - 3\right\| - \|-3 - 1\|$	**M1**	For correct substitution of *their* values for *a* and *b*
	$-\frac{3}{2}$	**A1**	
	Alternative $(5x + 2)^2 = (3x - 4)^2$ $16x^2 + 44x - 12 = 0$ oe	**(M1)**	For squaring and attempt to simplify to a 3-term quadratic equation equated to zero and attempt to solve
	$x = -3, \frac{1}{4}$	**(A2)**	**A1** for each
	$\left\|2\left(\frac{1}{4}\right) - 3\right\| - \|-3 - 1\|$	**(M1)**	For correct substitution of *their* values for *a* and *b*
	$-\frac{3}{2}$	**(A1)**	

Question	Answer	Marks	Partial Marks
3	$9kx + 1 = kx^2 + 3x(2k + 1) + 4$, leading to $kx^2 + x(3 - 3k) + 3$ [= 0] soi	**M1**	For equating the two equations and attempt to obtain a 3-term quadratic equation equated to zero.
	$(3 - 3k)^2 - (4 \times 3k)$	**M1**	**dep** on previous **M** mark for attempt to use the discriminant in any form
	$3k^2 - 10k + 3$ (< 0)	**M1**	**dep** on previous **M** mark for simplification to a 3-term quadratic equation in terms of k
	Critical values 3 and $\frac{1}{3}$	**A1**	For both
	$\frac{1}{3} < k < 3$	**A1**	
4(a)	Use of $\cot^2\theta + 1 = \mathrm{cosec}^2\theta$ leading to $\mathrm{cosec}\,\theta = \pm 5$ or other valid method	**2**	**M1** for use of correct identity or other valid method
	$\sin\theta = -\frac{1}{5}$ oe	**A1**	
4(b)	$\cos\theta = \frac{2\sqrt{6}}{5}$ oe	**2**	**M1** for $\cos\theta = \pm\sqrt{\frac{24}{25}}$ oe
5	$3y^2 + 2y - 1$ [= 0] oe or $4x^2 - 4x - 3$ [= 0] oe	**M1**	For obtaining a 3-term quadratic equation in y or x **and** an attempt to solve
	$x = \frac{3}{2}, y = \frac{1}{3}$ $x = -\frac{1}{2}, y = -1$	**A2**	**A1** for both x values correct or both y values correct or one correct pair
6(a)	Gradient of $PQ = \frac{12}{6}$, gradient of $QR = -\frac{4}{8}$ oe	**B1**	Must see sufficient detail e.g. difference in y-values/difference in x-values
	Product of gradients = –1 oe, so lines are perpendicular	**B1**	
6(b)	Midpoint of $PR = (3, -4)$	**2**	**B1** for each **FT** on *their* diameter
	Radius^2 = 65 oe	**2**	**M1** for correct method of finding the radius or radius^2 **FT** on *their* diameter
	$(x - 3)^2 + (y + 4)^2 = 65$ isw	**A1**	

Question	Answer	Marks	Partial Marks
7(a)	$2\pi r - 2r\theta + 2r\sin\theta$ or $2\pi r - 2r\theta + \sqrt{2r^2 - 2r^2\cos 2\theta}$	**3**	**B2** for 2 correct terms or **B1** for a correct arc length or chord length
7(b)	$\pi r^2 - r^2\theta + \frac{1}{2}r^2\sin 2\theta$	**3**	**B2** for 2 correct terms or **B1** for a correct sector area or correct area for triangle *ABC*
8(a)	$\frac{dy}{dx} = \tan x(3\cos 3x) + \sin 3x\sec^2 x$	**3**	**M1** for attempt at differentiation of a product **B1** for $3\cos 3x$ **A1** for all other terms correct
	$-3\sqrt{3}$	**A1**	
8(b)	$\frac{dy}{dt} = \textit{their}\ \frac{dy}{dx} \times 3$	**M1**	
	$-9\sqrt{3}$	**A1**	
8(c)	$-3\sqrt{3}h$	**B1**	**FT** on *their* answer to **(a)**
9(a)	$\frac{(4x-1)(2x+1)-(4x-1)+4(2x+1)^2}{(2x+1)^2(4x-1)}$	**M1**	For attempt to obtain a single fraction An extra term of $(2x + 1)$ throughout must be dealt with correctly before awarding **M1**
	$\frac{24x^2+14x+4}{(2x+1)^2(4x-1)}$	**A1**	Must see sufficient detail of expansion and collecting terms correctly to obtain the given answer.

Question	Answer	Marks	Partial Marks
9(b)	$\frac{1}{2}\ln(2x+1)$	**B1**	
	$\frac{1}{2(2x+1)}$	**B1**	Allow $\frac{-(2x+1)^{-1}}{-1\times 2}$ oe
	$\ln(4x-1)$	**B1**	
	$\left(\frac{1}{2}\ln 3+\frac{1}{6}+\ln 3\right)-\left(\frac{1}{2}\ln 2+\frac{1}{4}[+\ln 1]\right)$	**M1**	For correct application of limits, must have at least one logarithmic term Must be using individual fractions from part **(a)**. Fractions and logarithmic terms must be bracketed correctly and manipulated correctly
	$\frac{1}{2}\ln\frac{27}{2}-\frac{1}{12}$	**3**	**M1** for application of log laws using $\frac{1}{2}\ln 3+\ln 3-\frac{1}{2}\ln 2$ to obtain the correct form **A1** for $\frac{1}{2}\ln\frac{27}{2}$ **B1** for $-\frac{1}{12}$
10(a)	Velocity vector = $\begin{pmatrix}-8\\6\end{pmatrix}$	**2**	**M1** for obtaining 5 using the magnitude of the direction vector
	$\begin{pmatrix}30\\10\end{pmatrix}+\begin{pmatrix}-8\\6\end{pmatrix}t$	**B1**	**FT** for $\begin{pmatrix}30\\10\end{pmatrix}$ + (*their* velocity vector)t
10(b)	13	**B1**	

Question	Answer	Marks	Partial Marks
10(c)	$P: \begin{pmatrix} -50 \\ 70 \end{pmatrix}$ $Q: \begin{pmatrix} -30 \\ 30 \end{pmatrix}$	**M1**	For using $t = 10$ to find the position vector of each particle
	$\sqrt{20^2 + 40^2}$	**M1**	**dep** on previous **M** mark, for use of Pythagoras on the difference of the 2 position vectors
	$20\sqrt{5}$	**A1**	
11	$\dfrac{40n!}{(n-5)!5!} = \dfrac{2(n-1)(n+1)!}{(n-5)!6!}$ $40 = \dfrac{n^2-1}{3}$	**B2**	**B1** soi for simplifying numerical factorials to 3 **B1** for simplifying algebraic factorials to either $(n - 1)(n + 1)$ or $n^2 - 1$
	$n = 11$	**B1**	
12	$3 + \log_3 x = \dfrac{10}{\log_3 x}$ or $3 + \dfrac{1}{\log_x 3} = 10\log_x 3$	**B1**	For change of base
	$(\log_3 x)^2 + 3\log_3 x - 10 = 0$ or $10(\log_x 3)^2 - 3\log_x 3 - 1 = 0$ $\log_3 x = -5$ $\quad \log_3 x = 2$ or $\log_x 3 = -\dfrac{1}{5}$ $\quad \log_x 3 = \dfrac{1}{2}$	**M1**	**dep** on previous **B** mark, for attempt to obtain a 3-term quadratic equation and attempt to solve to obtain 2 solutions of the form $\log_3 x = p$ or $\log_x 3 = q$
	3^{-5} $\quad 3^2$ isw	**2**	**A1** for each

Question	Answer	Marks	Partial Marks
13	$\frac{dy}{dx} = me^{3x} + 2x^2 \ (+ c)$	**M1**	
	$\frac{dy}{dx} = 2e^{3x} + 2x^2 \ (+ c)$	**A1**	
	$5 = 2 + c$ $c = 3$	**M1**	**dep** on previous **M** mark
	$y = pe^{3x} + qx^3 \ (+ cx + d)$	**M1**	
	$y = \frac{2}{3}e^{3x} + \frac{2}{3}x^3 \ (+ cx + d)$	**A1**	
	$\frac{5}{3} = \frac{2}{3} + d$ $d = 1$	**M1**	**dep** on previous **M** mark
	$y = \frac{2}{3}e^{3x} + \frac{2}{3}x^3 + 3x + 1$	**A1**	
14	$\frac{dy}{dx} = \frac{(2x+1)\frac{4}{(4x-1)} - 2\ln(4x-1)}{(2x+1)^2}$	**3**	**B1** for $\frac{4}{(4x-1)}$ **M1** for attempt at differentiating a quotient or correct product **A1** for all other terms correct
	At A, $x = \frac{1}{2}$	**B1**	
	Gradient at $A = 2$	**2**	**M1** for substitution of *their* x into *their* $\frac{dy}{dx}$
	Equation of normal $y = -\frac{1}{2}\left(x - \frac{1}{2}\right)$	**2**	**M1 dep** on previous **M1** for attempt at normal equation using *their* values
	Coordinates of B $\left(0, \frac{1}{4}\right)$	**A1**	