Cambridge Assessment International Education

Cambridge IGCSE™

ADDITIONAL MATHEMATICS **0606/01**

Paper 1 **For examination from 2025**

MARK SCHEME

Maximum Mark: 80

Practice

This document has **10** 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 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.

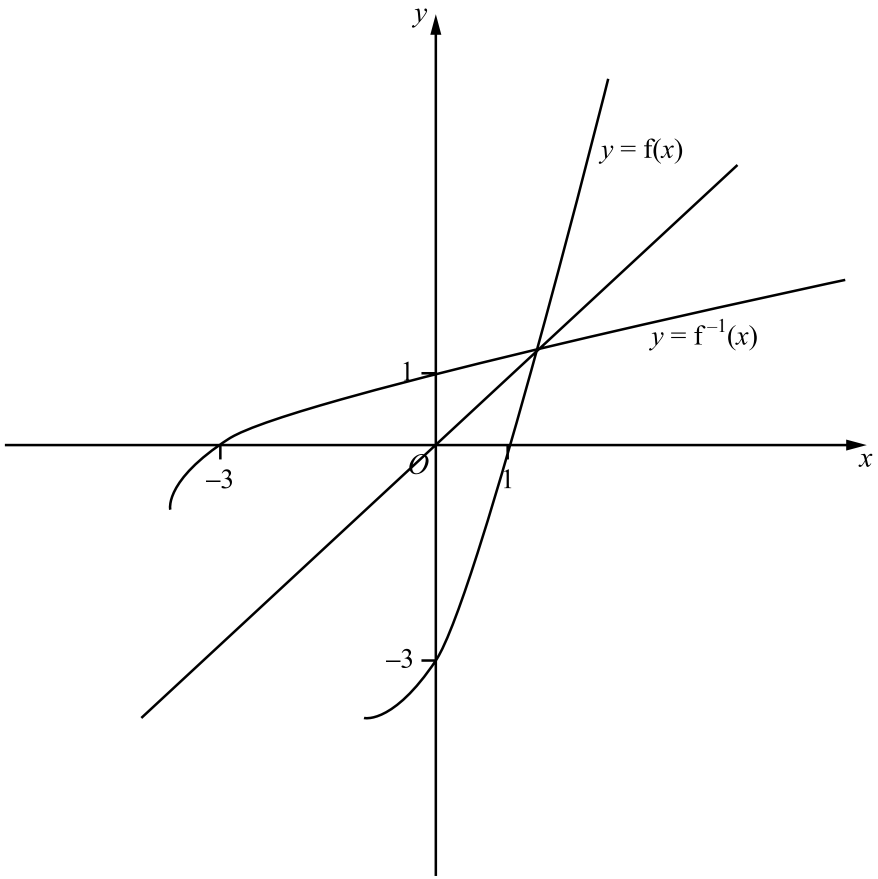
A Accuracy mark, given for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be earned or implied.

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	$2x^2 - (k+4)x + (k+4)\ (=0)$ $2x^2 + (-k-4)x + (k+4)\ (=0)$	**B1**	
	Discriminant: $(k+4)^2 - (4 \times 2 \times (k+4))$	**M1**	Use of discriminant to obtain 2 critical values using *their* 3-term quadratic
	± 4	**A1**	For critical values
	$k < -4 \quad k > 4$	**A1**	
2(a)	$y = -\frac{1}{2}(x+5)(x+1)(x-2)$	**3**	**B1** for negative soi
			B1 for $\frac{1}{2}$ soi
			B1 for $(x+5)(x+1)(x-2)$ or $x^3 + 4x^2 - 7x - 10$
2(b)	$-5 < x < -1$	**B1**	
	$x > 2$	**B1**	
3	$(5x+4)^2 * (2x-3)^2$ soi where * is any inequality sign or =	**M1**	
	$21x^2 + 52x + 7 * 0$	**A1**	
	Critical values: $-\frac{1}{7}, -\frac{7}{3}$, soi	**A1**	
	$-\frac{7}{3} \leqslant x \leqslant -\frac{1}{7}$ mark final answer	**A1**	**FT** *their* derived critical values
	Alternative		
	$5x + 4 * 2x - 3$ oe soi and $5x + 4 * 3 - 2x$ oe soi where * is any inequality sign or =	**(M1)**	
	Critical values: $-\frac{1}{7}, -\frac{7}{3}$, soi	**(A2)**	**A1** for $-\frac{1}{7}$ or $-\frac{7}{3}$
	$-\frac{7}{3} \leqslant x \leqslant -\frac{1}{7}$ mark final answer	**(A1)**	**FT** *their* derived critical values

Question	Answer	Marks	Partial Marks
4(a)	It is a one to one function because of the given restricted domain or because $x \geqslant -1$	**B1**	
4(b)		**4**	**B1** for $y = \mathrm{f}(x)$ for $x > -1$ only
			B1 for 1 on x-axis and –3 on y-axis for $y = \mathrm{f}(x)$
			B1 for $y = \mathrm{f}^{-1}(x)$ as a reflection of $y = \mathrm{f}(x)$ in the line $y = x$, maybe implied by intercepts with axes
			B1 for 1 on y-axis and –3 on x-axis for $y = \mathrm{f}^{-1}(x)$

Question	Answer	Marks	Partial Marks
5(a)	LHS = $\dfrac{\sin x \times \dfrac{\sin x}{\cos x}}{1-\cos x}$	**M1**	Accept other alternative correct methods. Uses $\tan x = \dfrac{\sin x}{\cos x}$
	$= \dfrac{1-\cos^2 x}{\cos x(1-\cos x)}$	**M1**	**dep** for use of $\sin^2 x = 1 - \cos^2 x$ to eliminate $\sin x$
	$\dfrac{(1-\cos x)(1+\cos x)}{\cos x(1-\cos x)} = \dfrac{1+\cos x}{\cos x} = \sec x + 1$	**2**	**M1 dep** factorises and cancels correctly. **A1** for use of $\dfrac{1}{\cos x} = \sec x$
5(b)	$\sin x(\cos x)^{-2}$	**B1**	
	$\tan x \sec x$	**B1**	Must show sufficient detail
6	$x + y = 9$	**B1**	
	$(x+1)^2 = y + 2$	**B1**	
	$x + (x+1)^2 - 2 = 9$ or $(10 - y)^2 = y + 2$	**M1**	Eliminate y or x to obtain a quadratic function in one variable Allow unsimplified using *their* 3-term expressions both containing x and y terms. Condone one sign or arithmetic error.
	$x^2 + 3x - 10$ (= 0) or $y^2 - 21y + 98$ (= 0)	**A1**	
	$x = 2$, $y = 7$	**2**	**M1 dep** solution of *their* 3-term quadratic equation **A1** for discounting negative x value and stating one solution only.

Question	Answer	Marks	Partial Marks
7(a)	$y^3 = m\ln x + c$	**B1**	May be implied by subsequent work
	$5 = m + c$ $15 = 6m + c$ $m = 2,\ c = 3$	**2**	**B1** for $m = 2$ **B1** for $c = 3$
	$y = \sqrt[3]{2\ln x + 3}$	**B1**	
	Alternative $y^3 = m\ln x + c$	**(B1)**	May be implied by subsequent work
	Gradient = 2	**(B1)**	For finding the gradient and equating to m
	$5 = m + c$ $15 = 6m + c$ $c = 3$	**(B1)**	For at least one correct equation and finding c
	$y = \sqrt[3]{2\ln x + 3}$	**(B1)**	
7(b)	$x > e^{-2}$	**2**	**M1** for a correct method to obtain the critical value of x
8(a)	p(2): $48 + 4a + 2b + 2 = 0$ $2a + b + 25 = 0$	**B1**	For $2a + b + 25 = 0$ or multiple
	$p(1) = -2p(0)$ $a + b + 12 = 0$	**B1**	For $a + b + 12 = 0$
	$a = -13,\ b = 1$	**2**	**M1** for attempt to solve *their* equations in a and b leading to 2 values **A1** for both
8(b)(i)	$p\left(\frac{1}{2}\right) = \frac{6}{8} - \frac{13}{4} + \frac{1}{2} + 2$	**M1**	For attempt to find $p\left(\frac{1}{2}\right)$ using *their* a and b
	0	**A1**	
8(b)(ii)	$(x - 2)(2x - 1)(3x + 1)$	**2**	**M1** for realising that 2 factors are known and 3rd factor can be found by observation or algebraic long division, or for making use of $x - 2$ or $2x - 1$ in order to obtain a quadratic factor **A1** Must see all factors together

Question	Answer	Marks	Partial Marks
9(a)	When $x = 1$, $y = 8$	**B1**	
	$\frac{dy}{dx} = 3x^2 - 12x + 3$	**M1**	For obtaining the form $ax^2 + bx + c$
	When $x = 1$, $\frac{dy}{dx} = -6$	**A1**	
	Equation of tangent $y = -6x + 14$	**A1**	
9(b)	$x^3 - 6x^2 + 9x - 4$ (= 0) Leading to either $(x - 1)(x^2 - 5x + 4)$ (= 0) or $(x - 4)(x^2 - 2x + 1)$ (= 0)	**2**	**M1** for equating *their* tangent to curve and simplifying to 4-term cubic.**M1 dep** for either finding a factor or stating that $(x - 1)$ is a factor or for making at least 3 attempts to find a factor.
	$(x - 1)(x - 1)(x - 4)$ (= 0)	**2**	**A1** for $(x - 1)$ or $x = 1$ nfww **A1** for $x - 4$ or $x = 4$ not repeated nfww
	(4, –10)	**A1**	Must have shown sufficient correct detail
10	$1 + \frac{2}{x} + \frac{1}{x^2}$	**2**	**B1** for 2 correct terms
	$x + 2\ln x - \frac{1}{x}$	**2**	**B1** for 2 correct terms
	$\left[4 + 2\ln 4 - \frac{1}{4}\right] - \left[2 + 2\ln 2 - \frac{1}{2}\right]$	**M1**	For correct substitution of limits into *their* integral, must have at least one **B1** from each of the two sets of **B** marks
	$\frac{9}{4} + 2\ln 2$ oe	**A1**	
11(a)	$2\mathbf{b} + \mathbf{a}$	**B1**	
11(b)	$2\mathbf{a} - 2\mathbf{b}$	**B1**	
11(c)	$2\mathbf{b} + \mathbf{a} + \mu(2\mathbf{a} - 2\mathbf{b})$	**B1**	**FT** on *their* part **(a)** and **(b)**
11(d)	$\lambda(3\mathbf{a} + 2\mathbf{b})$	**B1**	
11(e)	$3\lambda = 1 + 2\mu$ $\lambda = 2 - 2\mu$ leading to $\lambda = \frac{3}{4}$, $\mu = \frac{5}{8}$	**3**	**M1** for equating like vectors using parts **(c)** and **(d)** and forming two 3-term simultaneous equations **M1 dep** for solution to obtain both values

Question	Answer	Marks	Partial Marks
12(a)	Centre (1, –3)	2	**B1** for each
	Gradient of radius = 3 so gradient of the tangent is $-\frac{1}{3}$	M1	**FT** on *their* radius gradient
	$y = -\frac{1}{3}(x-2)$	2	**M1 dep** for attempt at gradient using *their* perp gradient
12(b)	Radius = $\sqrt{10}$	2	**M1** for attempting to find the radius of C_1, may be seen in part **(a)**, but must be used in part **(b)**
	Centre (3, 6)	2	**B1** for each
	$(x-3)^2 + (y-6)^2 = 10$	A1	
13	$\cos\theta = x - 2$ and $\sin\theta = \frac{2}{y}$ soi	B1	
	$(x-2)^2 + \frac{4}{y^2} = 1$	M1	For a correct attempt to use $\cos^2\theta + \sin^2\theta = 1$ or other relevant identity
	$y^2 = \frac{4}{1-(x-2)^2}$ oe	M1	**dep** attempt to rearrange to obtain y^2
	$y = \frac{2}{\sqrt{1-(x-2)^2}}$ or $\frac{2}{\sqrt{4x-x^2-3}}$ oe	A1	Must be positive