Cambridge Assessment International Education

Cambridge IGCSE™

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/61**

Paper 6 (Extended) **May/June 2023**

MARK SCHEME

Maximum Mark: 60

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 May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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[Turn over

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 descriptors 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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Maths-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, 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 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 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

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Partial Marks</th></tr>
<tr><td rowspan="2">1(a)</td><td>4 [+] 4 [+] 2 or 2 × 4 + 2
or lines or symbols on grid implying
4 horizontal or 4 vertical and 2 diagonal</td><td>C1</td><td></td></tr>
<tr><td>10</td><td>1</td><td></td></tr>
<tr><td>1(b)</td><td>12</td><td>1</td><td></td></tr>
<tr><td>1(c)</td><td>2n + 2 or 2(n + 1) final answer</td><td>2</td><td>B1 for final answer of form 2n + k
or a correct but unsimplified answer such as $n \times 2 + 2$
or a correct answer seen and then spoiled</td></tr>
<tr><td rowspan="2">2(a)</td><td>Diagrams implying 6 correct horizontal or
6 correct vertical</td><td>C1</td><td></td></tr>
<tr><td>6 6 8 20</td><td>1</td><td></td></tr>
<tr><td rowspan="2">2(b)</td><td>Diagrams showing exactly 4 diagonals in the same direction</td><td>C1</td><td></td></tr>
<tr><td>8 8 8 24</td><td>1</td><td></td></tr>
<tr><td>2(c)</td><td><table><tr><td>6</td><td>6</td><td>8</td><td>20</td></tr><tr><td>8</td><td>8</td><td>8</td><td>24</td></tr><tr><td>10</td><td>10</td><td>8</td><td>28</td></tr><tr><td>2n</td><td>2n</td><td>8</td><td>4n + 8</td></tr></table></td><td>2</td><td>B1 for 10 10 8 28
or 2n 2n 8 4n + 8 oe
or their horizontal expressions and their vertical expressions equal and their correct expression for total using 8 for diagonals for both 5 by 5 row and n by n row</td></tr>
<tr><td rowspan="6">2(d)</td><td>4n + 8 = square number < 50</td><td>C1</td><td>FT their 4n + 8</td></tr>
<tr><td>Two correct stages shown in the solution of their equation</td><td>C1</td><td>e.g. subtraction of 8 and division by 4</td></tr>
<tr><td>7 by 7</td><td>1</td><td></td></tr>
<tr><td>Alternative method</td><td></td><td></td></tr>
<tr><td>extending correct totals to 36</td><td>(C1)</td><td></td></tr>
<tr><td>showing grid sizes or values of n with totals
or 4 × 6 + 8 = 32
4 × 7 + 8 = 36</td><td>(C1)</td><td>FT their table if linear totals
FT their 4n + 8</td></tr>
<tr><td>7 by 7</td><td>(1)</td><td></td></tr>
</table>

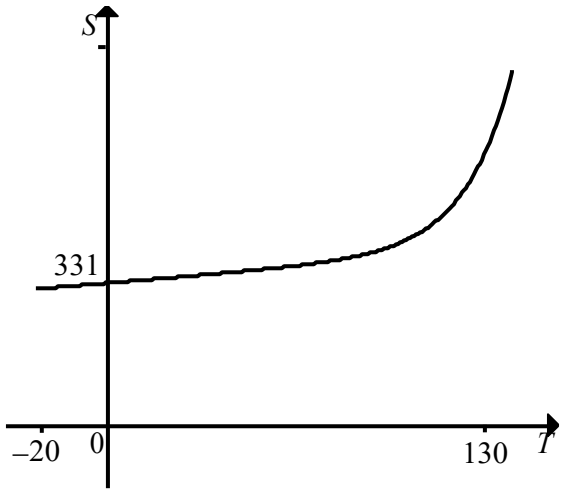
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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Partial Marks</th></tr>
<tr><td>3(a)</td><td>
<table>
<tr><td>2</td><td>2</td><td>2</td><td>6</td></tr>
<tr><td>4</td><td>3</td><td>4</td><td>11</td></tr>
<tr><td>6</td><td>4</td><td>6</td><td>16</td></tr>
<tr><td>8</td><td>5</td><td>8</td><td>21</td></tr>
<tr><td>$2w - 2$ oe</td><td>w</td><td>$2w - 2$ oe</td><td>$5w - 4$ oe</td></tr>
</table>
</td><td>3</td><td>B1 for 6, 8, 16, 21 correctly placed
B1 for $2w - 2$ oe seen once or $5w - 4$ correctly placed</td></tr>
<tr><td>3(b)(i)</td><td>One winning line in each column oe</td><td>1</td><td></td></tr>
<tr><td>3(b)(ii)</td><td>$n(w - n + 1)$ oe final answer</td><td>2</td><td>B1 for $w - n + 1$ seen</td></tr>
<tr><td>3(b)(iii)</td><td>$n(w - n + 1) + w + 2(w - n + 1)$ oe, isw</td><td>1</td><td>FT their part (b)(ii) if algebraic in n and w</td></tr>
<tr><td rowspan="3">3(b)(iv)</td><td>Correct substitution of $2n$ for w in their 3b(iii)</td><td>M1</td><td>FT their part (b)(iii) if algebraic in n and w</td></tr>
<tr><td>Correct simplification to the form $an^2 + bn + c$ where a and at least one of b and c is non-zero</td><td>M1</td><td>FT their part (b)(iii) providing it contains a term in nw and a term in n^2</td></tr>
<tr><td>Reduction to given expression $n^2 + 5n + 2$ with no errors</td><td>A1</td><td></td></tr>
<tr><td rowspan="2">4(a)</td><td>One diagram with n at least 3 and $w > n$ showing all the correct diagonals in one direction</td><td>C1</td><td></td></tr>
<tr><td>$4(w - n + 2)$ oe final answer</td><td>2</td><td>B1 for $w - n + 2$ oe or for a correct expression stated but then spoiled</td></tr>
</table>

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Question	Answer	Marks	Partial Marks
4(b)	$n(w - n + 2) + 2w +$ *their* $4(w - n + 2) = 54$	**C1**	**FT** *their* part **(a)** if algebraic in n and w
	Correct substitution of $n = 4$ into *their* expression in n and w for the total number of lines [= 54] and correct simplification to single w term	**C1**	must not be substituting into $n(w - n + 2)$ or $n(w - n + 2) + 2w$ only
	7 nfww	**1**	
	Alternative method		
	24, 34, 44, 54 with evidence of supporting diagrams or indication that the relationship is linear such as $10w - 16$ or showing [10(4) – 16 = 24] 10(5) – 16 = 34 10(6) – 16 = 44 [10(7) – 16 = 54]	**(C2)**	**C1** for 24, 34, 44, 54 or $10w - 16$ or [10(4) – 16 = 24] 10(5) – 16 = 34 10(6) – 16 = 44 [10(7) – 16 = 54]
	7 nfww	**(1)**	
5(a)	The four remaining points correctly plotted and ruled line joining the points	**3**	**B1** for 3 points correctly plotted **B1** for line of best fit for *their* points within tolerance
5(b)	$S = 0.6T + 331$ oe, isw	**2**	**B1** for $0.6T + 331$ oe or $10S = 6T + 3310$ oe
5(c)(i)	Correct substitution of 27 for T in *their* model or point marked at $T = 27$ on graph or $343 + \frac{7}{10} \times 6$	**C1**	**FT** *their* line from part **5(a)** or *their* model from part **5(b)** if necessary
	347 or 347.2	**1**	
5(c)(ii)	347[.2] × 5 or 0.347 × 5 or 1740 metres or 1736 metres or 1735 metres	**C1**	**FT** *their* part **5(c)(i)**
	1.74 or 1.736 or 1.735	**1**	**FT** *their* part **5(c)(i)** providing the answer is positive

Question	Answer	Marks	Partial Marks
6(a)	Five differences of 0.25 oe or five correctly evaluated gradient calculations and These are the same oe or The gradient is constant oe or When humidity increases by 20 (%) the speed of sound [always] increases by 0.25 oe	**2**	**B1** for three differences of 0.25 oe or three correctly evaluated gradient calculations OR for two differences of 0.25 or two correctly evaluated gradient calculations and a valid comment These are the same oe or The gradient is constant oe or When humidity increases by 20 (%) the speed of sound [always] increases by 0.25 oe
6(b)(i)	0.25 ÷ 20 = 0.0125 oe	**1**	
6(b)(ii)	[S =] 331.37 + *their* 0.6T + 0.0125H	**1**	**FT** the gradient from *their* linear model in part **5(b)**
6(c)	Correct substitution of [T =] 20 and [H =] 63	**C1**	**FT** *their* part **6(b)(ii)**
	Correct use of $\frac{1000}{\text{speed in m/s}}$ or $\frac{1}{\text{speed in km/s}}$ at least once	**C1**	
	0.00666 or 0.006663 to 0.006 69 nfww	**2**	**B1** for 2.91231[0…] or 2.90565 or 2.905646[3…]
7(a)	1.069	**3**	**M2** for $\sqrt[40]{350 \times 0.0412}$ oe or **M1** for $0.0412H = \frac{k^{40}}{350}H$ oe or $[k^{40} =]\ 350 \times 0.0412$ or 14.42 or $\frac{721}{50}$
7(b)	$[S =] 331.37 + 0.6T + \frac{1.069^T}{350}H$	**1**	**FT** *their* (331.37 + 0.6T) from part **6(b)(ii)** and *their* k from **7a**

Question	Answer	Marks	Partial Marks
7(c)	Correct sketch  	**2**	continuous curve with • initial straight section and section of correct curvature in reasonable proportions • starting to the left of the *S*-axis and ending reasonably close to or beyond $T = 130$ • positive *S*-intercept • must not touch *T*-axis between –20 and 130 **B1** for a continuous curve of reasonable shape with a straight section of any length and a section of correct curvature; may not be in reasonable proportions; may not cross the *S*-axis
	intercept marked at S = awrt 331 or for a graph ending at $T = 130$ level with tick mark on *S*-axis: awrt 827 marked at the tick mark or 500 to 1000 marked at the tick mark on the *S*-axis, consistent with their end point	**C1**	
7(d)	[S =] 359.4 to 360	**2**	**FT** *their* model providing it is of the form $S = x + yT + \frac{k^T}{350}H$ with x, y and k constants **B1 FT** *their* model from part 7(b) or *their* graph from part 7(c) for substitution of [T =] 45 and [H =] 25 in *their* model or for point marked on *their* sketch at approx $T = 45$
	Calculation showing relevant distance ÷ *their* speed with use of at least one relevant unit conversion	**C2**	**C1** for calculation showing relevant distance ÷ *their* speed or use of at least one relevant unit conversion
	12 22 38 oe nfww	**2**	**B1** for awrt 4.63 [min] or awrt 278 [s] or awrt 0.0772 [h] nfww