Cambridge Assessment International Education

Cambridge O Level

MATHEMATICS (SYLLABUS D) **4024/12**

Paper 1 **October/November 2023**

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 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

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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 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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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.

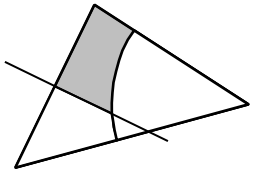
6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

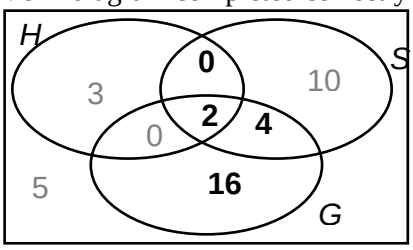
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

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Question	Answer	Marks	Partial Marks
1(a)	0.015	**1**	
1(b)	3000	**1**	
1(c)	14	**1**	
2	$\frac{5}{21}$ cao	**1**	
3(a)	0.64 cao	**1**	
3(b)	4.074 cao	**1**	
3(c)	4	**1**	
4(a)	13	**1**	
4(b)	3	**1**	
5	28	**2**	**M1** for $\frac{8}{9-5}$ [×*k*] where *k* = 1, 5, 9 or (5 + 9) oe or $\frac{x}{x+8}=\frac{5}{9}$ oe or $\frac{x-8}{x}=\frac{5}{9}$ oe or $5y+8=9y$ oe
6(a)	73	**1**	
6(b)	107	**1**	**FT** 180 – *their* 73 Dep on 0 < *their* 73 < 180 and *their* 73 ≠ 90
7(a)	Rotation 90° clockwise oe [centre] (0, 0)	**3**	**B1** for each
7(b)	Shape drawn at (–7, 2), (–1, 2), (–1, –4), (–4, –4), (–4, –1), (–7, –1)	**3**	**B2** for correct size and orientation, wrong centre or 5 correct vertices plotted or **B1** for length scale factor = 3 soi or for correct enlargement centre (5, 5) with scale factor 2 or 0.5
8(a)	4.93×10^{-3} cao	**1**	
8(b)	8×10^{7} cao	**1**	
9(a)	$2^2 \times 3^2 \times 5$ or 2 × 2 × 3 × 3 × 5	**2**	**B1** for list 2, 2, 3, 3, 5 or **M1** for any two stages correct in factor tree or ladder method

Question	Answer	Marks	Partial Marks
9(b)	5 cao	**1**	
10	1000 and 4 and 10 seen as rounded values **and** final answer 20	**2**	**B1** for two of 1000, 4 or 10 seen as rounded values
11	$m \leqslant 3$ or $3 \geqslant m$ final answer	**2**	**M1** for isolating term in m e.g. $7m$ […] 8 + 13 oe
12	Correct method to eliminate one variable	**M1**	
	$[x =] 4$ $[y =] -\frac{3}{2}$ oe	**A2**	**A1** for either $x = 4$ or $y = -\frac{3}{2}$ or after **A0**, **SC1** for a pair of values that satisfy either equation or for correct answers with no working
13	51	**2**	**M1** for 12 × 8 soi or 5 × 9 soi
14(a)	47 to 51	**1**	
14(b)	Acceptable bisector of line AC with correct arcs	**2**	**B1** for acceptable bisector of line AC with no/incorrect arcs
14(c)	Correct region shaded 	**2**	**FT** *their* bisector **B1** for arc centre B, radius 6 cm **B1** for correct shading, FT *their* arc centre B and *their* bisector dependent on region with bisector and arc as edges
15(a)	32 24 20	**2**	**B1** for one correct term in correct position or **M1** for $\frac{16-28}{3}$ oe soi
15(b)	$2n^2 + 1$ oe final answer	**2**	**B1** for a quadratic expression in n as answer or for correct answer seen or for at least two second differences of 4 seen
16(a)	6	**1**	
16(b)	$T^2 + 4$ final answer	**2**	**M1** for $T^2 = P - 4$ or better
17(a)	Correct cumulative frequency diagram	**2**	**B1** for at least 5 points plotted correctly

Question	Answer	Marks	Partial Marks
17(b)	Strict **FT** *their* UQ – *their* LQ evaluated	**2**	**FT** *their* increasing curve/polygon **B1 dep** for *their* UQ written or *their* LQ written, dependent on increasing curve/polygon
17(c)	Correct reading of H when CF is 52	**2**	**FT** *their* increasing curve/polygon **M1** for 52 soi
18(a)	$\frac{6}{20}$ oe	**1**	
18(b)	B 20 nfww	**3**	**M1** for [distance B =] 5×20 oe **M1** for [distance A =] $\frac{(1+7)\times 20}{2}$ oe OR **M2** for $4\times 20-\frac{1}{2}\times(7-1)\times 20$
19	$\frac{9x+2}{16}$ final answer	**2**	**M1** for $\frac{2(x+1)+4\times 3x-5x}{16}$ oe
20(a)	$(c-3)(2d+e)$ final answer	**2**	**B1** for one correct partial factorisation seen or for correct answer seen
20(b)	$3(v-3t)(v+3t)$ final answer	**2**	**B1** for $(3v-9t)(v+3t)$ seen or $(v-3t)(3v+9t)$ seen or $3(v^2-9t^2)$ seen or for correct answer seen
21(a)	$\frac{360-6x}{360}\times 2\pi\times\frac{3y}{4}=9\times\frac{x}{360}\times 2\pi y$ or $2\pi\times\frac{3y}{4}-\frac{6x}{360}\times 2\pi\times\frac{3y}{4}=9\times\frac{x}{360}\times 2\pi y$	**M2**	**M1** for $\frac{x}{360}\times 2\pi y$ oe or for $\frac{6x}{360}\times 2\pi\times\frac{3y}{4}$ oe or for $(360-6x)$ seen
	At least one extra step of rearrangement leading to $x = 20$	**A1**	A0 if any errors or omissions
21(b)	6	**2**	**M1** for $\frac{20\times\pi\times y^2}{360}=2\pi$ oe or better
22(a)	$x(x-1)+3\times 2$ [$=2x+6$]	**M1**	
	$x^2-x+6=2x+6$ leading to $x^2-3x=0$	**A1**	Brackets expanded and no errors or omissions seen

Question	Answer	Marks	Partial Marks
22(b)(i)	3, 0	**2**	**M1** for $x(x - 3)$ [= 0] seen or for $\frac{3 \pm \sqrt{9}}{2}$ seen or for $\frac{3}{2} \pm \sqrt{\frac{9}{4}}$ seen
22(b)(ii)	12	**2**	**M1** for $2(x - 1) + 2(x + 1)$ [= y] oe or better or for 2(*their* $x - 1$) + 2(*their* $x + 1$) [= y]
23(a)	Venn diagram completed correctly  	**2**	**B1** for 2 values correct in correct position
23(b)	10 cao	**1**	
24(a)(i)	2**b** – **a** final answer	**1**	
24(a)(ii)	$\frac{3}{2}$**a** + 5**b** final answer or $\frac{3\mathbf{a}+10\mathbf{b}}{2}$ final answer	**3**	**M1** for a correct vector route for $\overrightarrow{OB}$ along the lines of the diagram or $[\overrightarrow{AB} =] \frac{5}{2}\overrightarrow{AP}$ or $2\overrightarrow{AB} = 5\overrightarrow{AP}$ oe stated or $[\overrightarrow{PB} =] \frac{3}{2}\overrightarrow{AP}$ or $2\overrightarrow{PB} = 3\overrightarrow{AP}$ oe stated **B1 FT** for $\left[\overrightarrow{AB} =\right] \frac{5}{2}$ *their* (2**b** – **a**) oe or $\left[\overrightarrow{PB} =\right] \frac{3}{2}$ *their* (2**b** – **a**) oe
24(b)	$\frac{3}{5}$**a** + 2**b** oe	**1**	**FT** $\frac{2}{5} \times$ *their* $\overrightarrow{OB}$ or $\frac{2}{\textit{their } 5} \times$ *their* $\overrightarrow{OB}$