Cambridge Assessment International Education

Cambridge O Level

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

Paper 1 **October/November 2021**

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 2021 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.

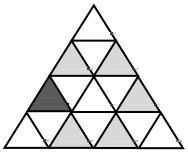
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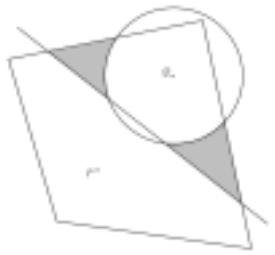
Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, 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.

Abbreviations

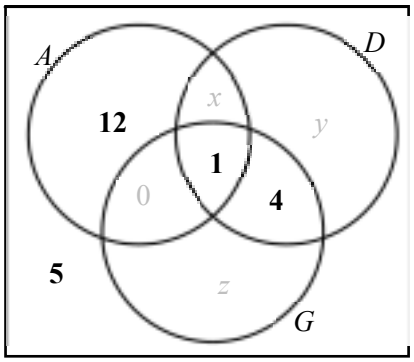
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

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Question	Answer	Marks	Partial Marks
1(a)	70 cao	**1**	
1(b)	125 cao	**1**	
2	–43 cao	**1**	
3	Correct small triangle shaded 	**1**	
4	Cuboid [Square based] pyramid [Triangular] prism	**3**	**B1** for each
5(a)	[$\angle CXG$ =] 99	**1**	
5(b)	[$\angle BCX$ =] 53	**1**	
5(c)	[$\angle ABX$ =] 134	**1**	
6(a)	230	**1**	
6(b)	$2\frac{13}{21}$ cao	**2**	**M1** for $\frac{11}{7}\times\frac{5}{3}$ or $\frac{55}{35}\div\frac{21}{35}$
7	8000 **and** 0.6 **and** 20 seen as rounded values **and** final answer 240	**2**	**B1** for two of 8000, 0.6, 20 seen as rounded values
8(a)	60	**1**	
8(b)	70 000	**1**	
9(a)	$2^3 \times 3^3$ or $2 \times 2 \times 2 \times 3 \times 3 \times 3$	**2**	**B1** for list 2, 2, 2, 3, 3, 3 or **M1** for any two stages correct in factor tree or ladder method
9(b)	54 and 72	**2**	**B1** for [18 =] $2 \times 3 \times 3$ soi or **M1** for listing two or more of 36, 54, 72, 108
10(a)	Translation $\begin{pmatrix} 4 \\ -2 \end{pmatrix}$	**2**	**B1** for each

Question	Answer	Marks	Partial Marks
10(b)	Triangle at (4, 2), (4, 3), (2, 3)	**2**	**B1** for correct size and orientation but wrong position or **SC1** for triangle at (–4, –2), (–2, –3), (–4, –3)
10(c)	Triangle at (–1, –2), (–1, 4), (–4, –2)	**2**	**B1** for correct size and orientation but wrong centre
11(a)	Acceptable perpendicular bisector of PQ with correct arcs	**2**	**B1** for acceptable perpendicular bisector of PQ with no/incorrect arcs
11(b)	Correct shaded regions 	**3**	**FT** *their* perpendicular bisector **B2** for appropriate arc(s) of radius 3 cm, centre Q touching the sides of the quadrilateral or **B1** for appropriate arc(s) radius ≠ 3 cm, centre Q touching the sides of the quadrilateral or for 3 cm seen
12	$A\hat{C}D = D\hat{C}E$, shared angle $A\hat{D}C = D\hat{E}C = 90$, [given] $D\hat{A}C = E\hat{D}C$ [third] angles in a triangle Three angles equal, therefore the triangles are similar	**3**	**B2** for two correct pairs of angles with correct reasons or **B1** for one correct pair of angles with correct reason or two correct pairs of angles with incorrect/no reasons
13	10, 10, 10, 15, 40	**3**	**M1** for 5 × 17 soi **M1** for *their* largest = 4 × *their* smallest or if *their* middle three values sum to 35 or if *their* three smallest values are equal
14(a)	$\frac{15}{20}$ oe	**1**	
14(b)	Speed is constant oe	**1**	
14(c)	500 nfww	**3**	**B2** for answer 400 OR **M2** for complete method to find total area under the graph e.g. $\frac{1}{2}(10+30)\times 15 + \frac{1}{2}(5+15)\times 20$ oe or **M1** for correct method to find a relevant area under the graph soi

Question	Answer	Marks	Partial Marks
15	20	**2**	**M1** for $\frac{200-160}{200}[\times 100]$ oe or $\frac{160}{200}\times 100$ oe
16	$n > -\frac{9}{4}$ oe final answer	**2**	**M1** for correct isolation of terms in n e.g. $2n + 6n$ […] 5 – 23
17	$(3x – q)(2p + y)$ final answer	**2**	**B1** for one correct partial factorisation seen
18	$x \geqslant -4$ oe $y \geqslant 2$ oe $y \leqslant -\frac{1}{2}x + 5$ oe	**2**	**B1** for two of $x \geqslant -4$, $y \geqslant 2$, $y \leqslant -\frac{1}{2}x + 5$ oe
19	27	**2**	**B1** for $B\hat{O}Q = 54$ soi or $O\hat{B}Q = 90$ soi or $B\hat{O}Q = 2x$ soi
20	$\frac{1}{8}\begin{pmatrix} 2 & 2 \\ -1 & 3 \end{pmatrix}$ oe or $\begin{pmatrix} \frac{1}{4} & \frac{1}{4} \\ -\frac{1}{8} & \frac{3}{8} \end{pmatrix}$ oe	**2**	**B1** for $[k]\begin{pmatrix} 2 & 2 \\ -1 & 3 \end{pmatrix}$ oe or for $\frac{1}{8}\begin{pmatrix} \cdot & \cdot \\ \cdot & \cdot \end{pmatrix}$ oe
21(a)(i)	58	**1**	
21(a)(ii)	11	**2**	**B1** for 62 or 51 written
21(b)	21 to 24	**2**	**B1** for 96 to 99 written
22(a)	$\frac{2}{3}$ cao	**2**	**M1** for $3^3 = 27$ soi or $3^2 = 9$ soi or $\left(\sqrt[3]{27}\right)^2$
22(b)	$\frac{x^2}{2}$ final answer	**2**	**B1** for answer $\frac{x^2}{k}$ or $\frac{x^n}{2}$ or for $\left(\frac{2}{x^2}\right)^{-1}$ seen or for $\left(\frac{x^8}{16}\right)^{\frac{1}{4}}$ seen
23	$\frac{1}{5}$ oe	**3**	**M1** for $y = \frac{k}{(x+1)^2}$ oe **M1** for $y = \frac{\textit{their } k}{(9+1)^2}$ oe OR **M2** for $5 \times (1 + 1)^2 = y \times (9 + 1)^2$ oe
24(a)(i)	43	**1**	

Question	Answer	Marks	Partial Marks
24(a)(ii)	$\frac{x-6}{2}$ oe final answer	**2**	**M1** for correct first step: $y - 6 = 2x$ or $\frac{y}{2} = x + \frac{6}{2}$ or $x = 2y + 6$
24(b)	$\frac{1}{2}$ and -3	**3**	**B1** for $2x^2 + 5x - 3$ [= 0] **M1** for $(2x - 1)(x + 3)$ [= 0] or for $\frac{-5 \pm \sqrt{5^2 - 4\times2\times-3}}{2\times2}$ FT *their* 3-term quadratic equation
25(a)		**2**	**B1** for 2 or 3 values correctly placed
25(b)	[x =] 3 [y =] 6 [z =] 9	**3**	**B2** for $x = 3$ OR **M2** for $\frac{40 - 12 - 1 - 4 - 5}{1 + 2 + 3}$ soi or **M1** for $40 - 12 - 1 - 4 - 5$ soi or $x + y + z + 12 + 1 + 4 + 5 = 40$ oe
25(c)	$A \cap G \cap D'$ oe	**1**	
25(d)	(*their* x) + 1 evaluated	**1**	