Cambridge Assessment International Education

Cambridge O Level

MATHEMATICS (SYLLABUS D) **4024/22**

Paper 2 **May/June 2022**

MARK SCHEME

Maximum Mark: 100

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.

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This document consists of **8** printed 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 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, 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)(i)	1638[.00]	**1**	
1(a)(ii)	14.3 or 14.28 to 14.29	**2**	**M1** for $\frac{96-84}{84}[\times 100]$ oe or $\frac{96}{84}\times 100$ [−100] oe
1(b)	1020 nfww	**3**	**M2** for $1200\times\left(1-\frac{15}{100}\right)$ oe OR **M1** for $(1200\times 96)-\frac{15}{100}\times(1200\times 96)$ oe or **B1** for 17280 (cents) or (\$)172.8[0] **M1** for $\frac{\textit{their}97920}{96}$ oe After 0 scored, **SC2** for answer 1020 from consistent use of figs96
1(c)	10.1[0]	**2**	**M1** for $1.10\times\frac{3.5-1}{0.5}$ oe
1(d)	12.5[0]	**2**	**M1** for $\frac{100+7.2}{100}x=13.4[0]$ soi
2(a)	8	**2**	**M1** for $23 = 3\times 5 + q$ oe or $[q =] 23 - 3\times 5$ oe
2(b)	$7x - 8$ final answer	**2**	**B1** for answer $7x + k$ or $kx - 8$ with $k \neq 0$ or **M1** for $4x + 10 + 3x - 18$ or better
2(c)	–0.4 or $-\frac{2}{5}$ cao	**2**	**M1** for $5y = 1 - 3$ or better or $y+\frac{3}{5}=\frac{1}{5}$ or better
2(d)	$4r(3r - 2s)$ final answer	**2**	**B1** for correct answer seen and spoilt or answer $4(3r^2 - 2rs)$ or $r(12r - 8s)$ or $2r(6r - 4s)$
2(e)	$b=\frac{a}{3}$ or $b=\frac{1}{3}a$ final answer	**1**	
3(a)	63	**2**	**M1** for $\frac{35}{200}[\times 360]$ oe or $\frac{360}{200}[\times 35]$ oe or **B1** for answer 17.5[%]
3(b)	$\frac{28}{200}$ oe	**1**	

Question	Answer	Marks	Partial Marks
3(c)	$\frac{165}{200}$ oe	**2**	**M1** for 1, 2, 3, 5 soi After 0 scored, **SC1** for $\frac{114}{200}$ oe
3(d)	810	**2**	**M1** for $\frac{19+35}{200}[\times 3000]$ oe or **B1** for 810 seen
4(a)(i)	84	**2**	**M1** for correct area of a relevant triangle or trapezium
4(a)(ii)	50 nfww	**3**	**M2** for $\sqrt{(12-4)^2+(15-9)^2}$ soi OR **M1** for $\sqrt{8^2+k^2}$ oe or $\sqrt{k^2+6^2}$ oe **M1** for 12 + 15 + 4 + 9 + *theirh* where *theirh* is from use of Pythagoras
4(b)	8.49 to 8.5[0…]	**3**	**M2** for $r^3 = \frac{2572\times 3}{4\times\pi}$ oe or **M1** for $\frac{4}{3}\pi r^3 = 2572$
4(c)(i)	384	**3**	**M2** for (2×6 + 2×22.5 + 6×22.5) [×2] oe or **M1** for two different face areas seen
4c(ii)	$x^2 = \frac{their384}{6}$ OR $6x^2$ = *their* **(c)(i)** → x^2 = *their*64 OR $6x^2$ = *their* **(c)(i)** → $x = \sqrt{\frac{their384}{6}}$	**M2**	**M1** for $6x^2$ = *their* **(c)(i)** oe
	8 cao	**B1**	
5(a)(i)	39	**1**	
5(a)(ii)	147.5 or $147\frac{1}{2}$ cao nfww	**3**	**B1** for correct midpoints soi **M1** for $\frac{13\times 100+26\times 130+27\times 145+24\times 195}{13+26+27+24}$
5(b)(i)	22 36 46 8 or 22 35 47 8	**2**	**B1** for 2 or 3 correct
5(b)(ii)	192.5 to 197.5	**1**	

Question	Answer	Marks	Partial Marks
5(b)(iii)	212.5 to 217.5 nfww	**3**	**B2** for 84 soi or **M1** for $\frac{55}{100}\times 120$ or 18 + *their* 66
6(a)	Ruled line through (0, 3.5) and (7, 0)	**2**	**B1** for short or unruled line or for two correct coordinates soi
6(b)	$x = 1$ $y = 3$	**1**	**FT** where their line crosses $y = x + 2$ provided it crosses on given grid
6(c)(i)	Correct region clearly indicated	**2**	**FT** provided their region is a triangle using $x \leqslant 5$, $y \leqslant x + 2$ and *their* $x + 2y \geqslant 7$ **B1** for line $x = 5$ drawn correctly
6(c)(ii)(a)	7	**1**	
6(c)(ii)(b)	(2, 3) (3, 4) (4, 5)	**2**	**B1FT** for at least one correct and maximum of one incorrect
7(a)(i)	0.75 or $\frac{3}{4}$ or $\frac{6}{8}$	**1**	
7(a)(ii)	Travelling at a constant/uniform speed oe or Travelling at acceleration of 0 oe	**1**	
7(a)(iii)	104	**3**	**M2** for $\frac{1}{2}\times 6\times\left(T+(90-8)\right)[=558]$ oe or $\frac{1}{2}(T-90)\times 6=42$ oe or $\frac{1}{2}\times 6\times((90-8)+T-8)=534$ oe or **M1** for $\frac{1}{2}\times 8\times 6$ oe or $(90-8)\times 6$ oe or $\frac{1}{2}(90+(90-8))\times 6$ oe seen After 0 scored, **SC1** for answer 14
7(a)(iv)	21.6 or $21\frac{3}{5}$ cao	**2**	**B1** for answer figs 216 or **M1** for $\frac{6}{1000}\times 60$ [×60] oe
7(b)	84.9 or 84.93 to 84.94 nfww	**3**	**B1** for 352.5 or 4.15 seen **M1** for $\frac{\textit{their}352.5}{\textit{their}4.15}$
8(a)	$\begin{pmatrix}-1 & 0\\ 3 & 1\end{pmatrix}$	**2**	**B1** for 2 or 3 correct elements in final answer or $\begin{pmatrix}-3 & 0\\ 9 & 3\end{pmatrix}$ soi or $\begin{pmatrix}3 & 0\\ -9 & -3\end{pmatrix}$ soi

Question	Answer	Marks	Partial Marks
8(b)	$\frac{1}{2}\begin{pmatrix}-3 & 2\\ -4 & 2\end{pmatrix}$ or $\begin{pmatrix}-1.5 & 1\\ -2 & 1\end{pmatrix}$	**3**	**B2** for $p = -3$ OR **M1** for $2p - (4 \times -2) = 2$ oe **B1** for $\frac{1}{2}\begin{pmatrix}their\ p & 2\\ -4 & 2\end{pmatrix}$ oe
8(c)(i)	Translation $\begin{pmatrix}-4\\ 3\end{pmatrix}$	**2**	**B1** for translation or $\begin{pmatrix}-4\\ 3\end{pmatrix}$ with no further properties
8(c)(ii)	Shape C at (2, –4) (–4, –4) (–4, –2) (0, –2)	**2**	**B1** for three vertices correct or three correct pairs of coordinates soi
9(a)	$20^2 - 11^2$ or $\sqrt{20^2 - 11^2}$ or $PQ^2 + 11^2 = 20^2 \rightarrow PQ^2 = 279$	**M1**	
	16.703…	**A1**	
9(b)	119.6 to 119.8	**5**	**M2** for $[QS =]\ \frac{16.70}{\tan 36}$ oe or **M1** for $\tan 36 = \frac{16.70}{QS}$ oe AND **M2** for $\cos[\ldots] = \frac{11^2 + (their 23)^2 - 30^2}{2 \times 11 \times their 23}$ oe or **M1** for $30^2 = 11^2 + (their 23)^2 - 2 \times 11 \times their 23 \times \cos[\ldots]$ oe
9(c)	24.3[0…]	**4**	**B1** for $[P\hat{T}Q =]\ 43^\circ$ **M2** for $\frac{16.7[0]\sin 97}{\sin(\text{their}43)}$ oe or **M1** for $\frac{\sin 97}{PT} = \frac{\sin(their 43)}{16.7[0]}$ oe

Question	Answer	Marks	Partial Marks
10(a)	$(e-6)^2+(e-4)^2$ oe or $\sqrt{(e-6)^2+(e-4)^2}$ oe	**M1**	
	$e^2-10e+16$ [=0] or $2e^2-20e+32$ [=0]	**A2**	**A1** for $e^2-6e-6e+36$ oe or $e^2-4e-4e+16$ oe
	$(e-2)(e-8)$ [=0] oe or $\frac{-(-10)\pm\sqrt{(-10)^2-4\times1\times16}}{2\times1}$ oe	**M1**	**FT** for factorising or correct use of formula for *their* 3-term quadratic
	(2, 2) and (8, 8)	**B1**	
10(b)(i)	2 nfww	**4**	**B1** for [grad perpendicular =] $-\frac{2}{3}$ soi **M2** for $\frac{5f-6}{-f-4}=their\left(-\frac{2}{3}\right)$ oe or **M1** for $\frac{5f-6}{-f-4}$ oe or $6=their\left(-\frac{2}{3}\right)\times4+c$ oe
10(b)(ii)	13 with (1, 8) seen	**3**	**M1** for $\left(\frac{4+(-theirf)}{2},\frac{6+(5\times theirf)}{2}\right)$ **M1** for substituting *their* (1, 8) into $2y=3x+k$ oe