Cambridge Assessment International Education

Cambridge O Level

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

Paper 2 **October/November 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.

Cambridge International is publishing the mark schemes for the October/November 2022 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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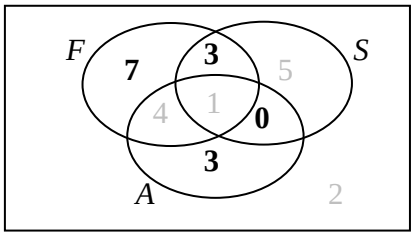
Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, 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)(i)	13 22, 23 01	**2**	**B1** for each
1(a)(ii)	2 [hours] 41 [minutes]	**1**	
1(b)	0.87	**3**	**M2** for $\frac{0.75\times 290}{250}$ oe or **M1** for $\frac{290}{250}$ oe seen or $\frac{250}{0.75}$ oe seen or $\frac{0.75}{r}=\frac{250}{290}$ oe seen
1(c)(i)	252	**2**	**M1** for $420\times 3\times\frac{20}{100}$ oe or **B1** for 84 seen or 252 seen
1(c)(ii)	12.6[0]	**3**	**B2** for answer 100.8[0] or **M2** for $\frac{85.68}{8}\times\frac{100}{100-15}$ oe or **M1** for $\frac{100-15}{100}x=85.68\left[\div 8\right]$ soi
2(a)(i)	18.9 or $18\frac{9}{10}$ nfww	**2**	**M1** for (17×5 + 18×2 + 19×7 + 20×3 + 21×2 + 22×1) ÷ (5 + 2 + 7 + 3 + 2 + 1)
2(a)(ii)	5	**1**	
2(a)(iii)	Type A has more tomatoes per plant oe Number of tomatoes per plant is more consistent for type A oe	**2**	**Strict FT** *their* mean and range **B1FT** for each
2(b)(i)	Correct cumulative frequency curve	**3**	**B2** for 4 or 5 points plotted correctly or **B1** for 4 or 5 correct cumulative frequencies soi
2(b)(ii)	13.3 to 15.8… nfww	**3**	**M1** for correct reading of *their* increasing curve at $m = 21$ **M1** for $\frac{120-y}{120}\left[\times 100\right]$

Question	Answer	Marks	Partial Marks
3(a)	$h = \frac{60}{x^2}$ seen $xh = \frac{60}{x}$ seen	**M1**	
	$[A =]2x^2 + 4x \times \frac{60}{x^2} \rightarrow 2x^2 + \frac{240}{x}$ $[A =]2x^2 + 4 \times \frac{60}{x} \rightarrow 2x^2 + \frac{240}{x}$	**A1**	**A0** if any errors **A0** if any errors
3(b)	98 112	**2**	**B1** for each
3(c)	Correct smooth curve	**3**	**B2FT** for 7 or 8 points correctly plotted or **B1FT** for 5 or 6 points correctly plotted
3(d)	90 to 92	**1**	**FT** *their* minimum point provided $\leqslant 92$
3(e)	x, x, h where $2.1 \leqslant x \leqslant 2.3$ with corresponding h	**3**	**M1** for a correct reading of *their* graph at $A = 120$ **M1** for $\frac{60}{(their 2.2)^2}$ or $\frac{120 - 2 \times (their 2.2)^2}{4 \times their 2.2}$
4(a)(i)	12, 16, 18, 24, 25, 30, 36	**1**	
4(a)(ii)	2	**1**	
4(b)	$(D \cup C) \cap B'$ oe	**1**	
4(c)(i)	Venn diagram completed correctly 	**2**	**B1** for 2 values correct
4(c)(ii)	$\frac{1}{30}$ oe	**2**	**M1** for $\frac{5}{25} \times \frac{4}{24}$ oe

Question	Answer	Marks	Partial Marks
4(c)(iii)	$\frac{45}{91}$ oe nfww	**3**	**M2** for $\frac{5}{15}\times\frac{10}{14}\times\frac{9}{13}\times k$ where k is 1, 2 or 3 oe or **M1** for $\frac{5}{15}\times\frac{10}{14}\times\frac{9}{13}$ seen and spoilt or $\frac{a}{x}\times\frac{b}{x-1}\times\frac{c}{x-2}[\times k]$ where x = n(*theirF*) and k is 1, 2 or 3 After 0 scored, **SC1** for answer $\frac{4}{9}$ oe
5(a)(i)	$x + y = 130$ final answer	**1**	
5(a)(ii)	$5x + 10y = 815$ oe final answer	**1**	
5(a)(iii)	Correct method to eliminate one variable	**M1**	**FT** *their* equations provided both equations cannot be written in the form $5x + 10y = k$ or both equations cannot be written in the form $x + y = k$
	[Five-cent coins =] 97 [Ten-cent coins =] 33 nfww	**A2**	**A1** for either $x = 97$ or $y = 33$ nfww After A0 scored, **SC1** for final answer two positive integers satisfying either $x + y = 130$ or $5x + 10y = 815$
5(b)	1.56×10^7 cao nfww	**3**	**B2** for 15 600 000 oe or 15 550 000 oe or 15 552 000 oe or answer (cao) 1.56×10^9 or 1.55×10^7 or 3.11×10^8 or 3.11×10^6 or 2.59×10^5 or 5.18×10^4 (nfww) or **M1** for $720 \times 24 \times 60 \times 300 \times 0.05$
5(c)	34	**3**	**B1** for 21.25 and 17.85 seen **M1** for [–](*their* 21.25 × 10 – *their* 17.85 × 10) oe
6(a)	Correct reflection (5, 2), (5, 5), (4, 2)	**2**	**B1** for reflection in $y = 1$ or reflection in $x = m$ where $-4 \leqslant m \leqslant 1.5$

Question	Answer	Marks	Partial Marks
6(b)	Rotation 90 anticlockwise oe (0, 0) oe	**5**	**M2** for triangle *C* at (–2, –2), (–2, –3), (–5, –3) or **M1** for triangle *D* translated by $\begin{pmatrix}-6\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-1\end{pmatrix}$ or for $\begin{pmatrix}-6\\-1\end{pmatrix}$ soi **B2dep** for two of: rotation 90 anticlockwise oe (0, 0) oe or **B1dep** for rotation or 90 anticlockwise oe or (0, 0) oe After 0 scored, **SC2** for answer $\begin{pmatrix}0&-1\\1&0\end{pmatrix}$
7(a)	83.4 or 83.36 to 83.43	**4**	**M1** for $160^2 + 95^2$ oe **M2** for [cos =] $\frac{107^2+165^2-their34625}{2\times107\times165}$ oe or **M1** for $(their34625) =$ $107^2+165^2-2\times107\times165\times\cos[\ ]$ oe
7(b)	9.2[2] or 9.218 to 9.219… nfww	**4**	**M2** for 107 tan 8.2 or $\frac{107}{\tan 81.8}$ or $\frac{107\sin 8.2}{\sin 81.8}$ oe or **M1** for $\tan 8.2 = \frac{\text{height}}{107}$ or $\tan 81.8 = \frac{107}{\text{height}}$ or $\frac{\sin 8.2}{\text{height}} = \frac{\sin 81.8}{107}$ oe **M1** for $\tan[\ ] = \frac{their\text{height}}{95}$ oe

Question	Answer	Marks	Partial Marks
8(a)	$5v-2w$ final answer	**2**	**B1** for correct answer seen and spoilt or answer $5v+kw$ or $kv-2w$ with $k\neq 0$
8(b)	3.4 or $3\frac{2}{5}$ or $\frac{17}{5}$ final answer	**2**	**M1** for $5x=10+7$ or better
8(c)(i)	a^4 final answer	**1**	
8(c)(ii)	b^{-2} or $\frac{1}{b^2}$ final answer	**1**	
8(d)(i)	43	**1**	
8(d)(ii)	$\frac{r+3t}{4}$ oe final answer	**2**	**M1** for $r + 3t = 4p$ or $–r – 3t = –4p$ or $\frac{r}{4}=p-\frac{3t}{4}$ or better
8(e)	$\frac{-3\pm\sqrt{3^2-4\times5\times-6}}{2\times5}$ oe or $\frac{-3}{2\times5}\pm\sqrt{\left(\frac{3}{2\times5}\right)^2-\frac{-6}{5}}$	**B2**	**B1** for $\sqrt{3^2-4\times5\times-6}$ oe or for $\frac{-3\pm\sqrt{their\text{discriminant}}}{2\times5}$ or for $\left(x+\frac{3}{2\times5}\right)^2$
	0.836 and –1.44	**B1**	
9(a)	$2\pi\times10^2+2\pi\times8^2+\pi\times10^2-\pi\times8^2$	**M2**	**M1** for $2\pi\times10^2$ seen or $2\pi\times8^2$ seen or $\pi\times10^2-\pi\times8^2$ seen
	Completion to 364π with at least one intermediate step isw AG	**A1**	**A0** if any errors or if π evaluated as 3.14[2…] or $\frac{22}{7}$ before getting to 364π
9(b)	756 or 756.2 to 756.4…	**3**	**M2** for $\left(\frac{2}{3}\pi\times10^3-\frac{2}{3}\pi\times8^3\right)\times0.74$ oe or **M1** for $\frac{2}{3}\pi\times10^3-\frac{2}{3}\pi\times8^3$ oe or $\left(\frac{2}{3}\pi\times k^3[+\ldots]\right)\times0.74$ oe with $k > 0$

Question	Answer	Marks	Partial Marks
9(c)	1390 or 1388 to 1390	**3**	**M2** for $\left(\sqrt{\frac{546}{364}}\right)^3$ oe soi or $\left(\sqrt{\frac{364}{546}}\right)^3$ oe soi or **M1** for $\sqrt{\frac{546}{364}}$ oe soi or $\sqrt{\frac{364}{546}}$ oe soi or $\frac{364^3}{546^3}=\frac{(theirb)^2}{V^2}$ oe
10(a)(i)	*AC* is common $\angle ACD = \angle CAB$ [given] $\angle ABC = \angle CDA$ [= 90°] angle in semicircle [Congruent] AAS	**3**	**B2** for two pairs of equal sides/angles with correct reasons or **B1** for $\angle ABC = \angle CDA$ angle in semicircle or *AC* is common or for two appropriate pairs with no/incorrect reasons
10(a)(ii)	Option 1: $\angle ACB = \angle CAD$ =50° since $\angle ABC = \angle CDA$ = 90° angle in semicircle Option 2: *AB* parallel to *DC* since $\angle ACD$ and $\angle CAB$ are alternate angles	**M1**	
	Option 1: Rectangle because $\angle DAB = \angle BCD = \angle ABC = \angle CDA$= 90° Option 2: $\angle ABC = \angle ADC$ = 90° angle in semicircle Rectangle because perpendicular parallel sides	**A1**	
10(b)	18.5 or 18.49 to 18.50…	**5**	**B2** for $\angle HOG$ = 112° soi or **B1FT** for $\angle OHG$ = 34° soi or $\angle HOG$ = 180 – 2 × *their* $\angle OHG$ **M1** for $\frac{their112}{360}\times\pi\times6^2$ oe **M1** for $\frac{1}{2}\times6^2\times\sin(their112)$ oe