Cambridge Assessment International Education

Cambridge O Level

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

Paper 1 **May/June 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 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.

© UCLES 2023

[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.

© UCLES 2023

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.

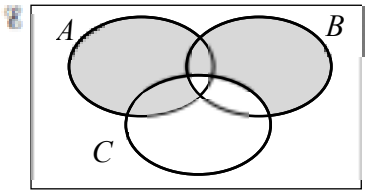
Abbreviations

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

© UCLES 2023

Question	Answer	Marks	Partial Marks
1(a)	1.52	**1**	
1(b)	1.44 oe	**1**	
2	Correct labels: Tangent Sector	**2**	**B1** for one correct
3	$\frac{11}{20}$ 0.595 62% $\frac{5}{8}$ 0.65	**2**	**B1** for four correct when one is covered up or for answer 0.65 $\frac{5}{8}$ 62% 0.595 $\frac{11}{20}$
4(a)	–4	**1**	
4(b)(i)	–1	**1**	
4(b)(ii)	12	**1**	
5	48	**2**	**M1** for $480 \times \frac{2}{100} \times 5$ oe
6(a)(i)	18.6 to 19.4	**2**	**B1** for 9.3 to 9.7 seen or **M1** for *their* distance in cm × 2 as answer
6(a)(ii)	238 to 242	**1**	
6(b)	Acceptable perpendicular bisector of *AB* with two pairs of correct arcs	**2**	**B1** for acceptable perpendicular bisector with no/incorrect arcs
7(a)	Positive	**1**	
7(b)	Ruled line of best fit	**1**	
7(c)	Reading from *their* straight line at $d = 5$	**1**	**FT** dependent on positive gradient
8	$2\frac{7}{12}$ final answer	**2**	**M1** for correct use of common denominator e.g. $\frac{21}{12} + \frac{10}{12}$ or $\frac{9}{12} + \frac{10}{12}$
9(a)	2	**1**	
9(b)	36 nfww	**2**	**M1** for $\frac{1}{2} \times 3 \times 3[\times 8]$ oe or for $\left[\frac{1}{2}\right] \times 3 \times 3 \times 8$ oe

Question	Answer	Marks	Partial Marks
10	Correct method to eliminate one variable	**M1**	
	$[x =] -3$ $[y =] 5$	**A2**	**A1** for either $x = -3$ or $y = 5$ If **A0** scored, **SC1** for a pair of values that satisfy either equation or for correct answers with no working
11	20 and 0.4 seen as rounded values **and** final answer 20 000 or 2×10^4	**2**	**B1** for 20 and 0.4 seen as rounded values
12(a)	Enlargement [scale factor] 2 [centre] (1, –1)	**3**	**B1** for each
12(b)	Correct rotation (–1, –1), (–1, –2), (–2, –2), (–3, –1)	**2**	**B1** for correct size and orientation but wrong position
13(a)	81	**1**	
13(b)	$39 - 4n$ oe final answer	**2**	**B1** for $-4n + k$ oe seen, any k
14(a)	$5^2 \times 13$ or $5 \times 5 \times 13$	**2**	**B1** for list 5, 5, 13 or **M1** for any two stages correct in factor tree or ladder method
14(b)	$x^{n-1}y^2$ final answer	**2**	**B1** for answer $x^{n-1}y^k$ or $x^k y^2$, any k
15(a)	$x + y \leqslant 5$ oe $y \leqslant 2x - 1$ oe $y \geqslant -2$ oe	**2**	**B1** for two correct
15(b)	1.5 oe	**1**	
16	2400	**2**	**M1** for correct method to find a relevant area under the graph soi by 1700, 700, 300, 2100 or 1400
17(a)	$\left[f^{-1}(x) =\right] \frac{2-x}{3}$ oe final answer	**2**	**B1** for $x = 2 - 3y$ or $y - 2 = 3x$ or $\frac{y}{3} = \frac{2}{3} - x$ or better
17(b)	$\left[x =\right] -\frac{1}{6}$	**3**	**B1** for $f(x+5) = 2 - 3(x+5)$ and $3g(x) = 3(x-4)$ soi **M1dep** for correct expansion of brackets and collection of terms e.g. $-3x - 3x = -12 - 2 + 15$ or better

Question	Answer	Marks	Partial Marks
18(a)	3	**1**	
18(b)(i)	$\begin{pmatrix}960\\300\end{pmatrix}$	**2**	**B1** for $\begin{pmatrix}960\\k\end{pmatrix}$ or $\begin{pmatrix}k\\300\end{pmatrix}$ or 960 **and** 300 seen in final answer
18(b)(ii)	Mass [of contents] of a large bag and mass [of contents] of a small bag	**1**	
19(a)	Correct shading 	**1**	
19(b)	7	**2**	**M1** for $B \cap C = 5$ soi or for $35 - x + 12 - x + 8 + x = 50$ oe
20(a)	$8x^2 + 18xy - 5y^2$ final answer	**2**	**B1** for 3 terms correct in $8x^2 - 2xy + 20xy - 5y^2$
20(b)	$\frac{x^8}{4}$ final answer	**2**	**B1** for answer $\frac{x^k}{4}$ or $\frac{x^8}{k}$, any k or for $\left(\frac{x^4}{2}\right)^2$ seen or $\left(\frac{x^{24}}{64}\right)^{\frac{1}{3}}$ seen
21	–2, 6	**4**	**B2** for $x^2 - 4x - 12[= 0]$ or **M1** for $[5x =]x^2 + 4x - 3x - 12$ or better AND **M1** for $(x-6)(x+2)[= 0]$ oe factorised expression or $\frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-12)}}{2}$ oe FT *their* 3-term quadratic

Question	Answer	Marks	Partial Marks
22	$[y =]\frac{4}{5x^2}$ final answer or $[y =]\frac{0.8}{x^2}$ final answer	**4**	**B3** for $\frac{4}{x}=\sqrt{20y}$ or $\frac{0.05}{y}=\left(\frac{x}{4}\right)^2$ oe or $y=\frac{1}{20}\left(\frac{4}{x}\right)^2$ oe seen OR **B2** for $y=\frac{w^2}{20}$ oe and $x=\frac{4}{w}$ oe or **B1** for $y=\frac{w^2}{20}$ oe or $x=\frac{4}{w}$ oe or $y=kw^2$ **and** $x=\frac{c}{w}$ OR **B2** for $y=\frac{k}{x^2}$ **M1** for $5=\frac{k}{0.4^2}$
23(a)	$\frac{49}{100}$ oe	**2**	**B1** for $\frac{7}{10}$ oe seen
23(b)	$\frac{42}{90}$ oe	**3**	**M2** for $\frac{4}{10}\times\frac{3}{9}+\frac{6}{10}\times\frac{5}{9}$ oe or **M1** for one correct product seen $\frac{4}{10}\times\frac{3}{9}$ or $\frac{6}{10}\times\frac{5}{9}$ If 0 scored, **SC1** for answer $\frac{52}{100}$ oe

© UCLES 2023

Question	Answer	Marks	Partial Marks
24	[Midpoint of AB =] (–1, 3)	**B1**	
	$\frac{11-(-5)}{3-(-5)}$ oe	**M1**	
	[Gradient of AB =] 2 and [Gradient of perpendicular =] $-\frac{1}{2}$ soi	**B1**	
	EITHER Method 1: $2\times3+-1=5$	**M1**	Or substitution of $x = -1$ or $y = 3$ into $2y + x = 5$ to evaluate corresponding y or x
	States (–1, 3) is on L oe and gradient $L = -\frac{1}{\text{gradient } AB}$ oe	**A1**	Dep on **B1M1B1M1**
	OR Method 2: substitution of (–1, 3) into $y=-\frac{1}{2}x+c$ oe	**(M1)**	or substitution of (–1, 3) into $y-y_1=-\frac{1}{2}(x-x_1)$
	correct rearrangement to $2y + x = 5$	**(A1)**	Dep on **B1M1B1M1** or $c=\frac{5}{2}$ oe and rearrangement of L to $y=-\frac{1}{2}x+\frac{5}{2}$