Cambridge Assessment International Education

Cambridge O Level

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

Paper 1 **May/June 2022**

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.

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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)	$\frac{5}{6}$ oe	**1**	
1(b)	[0].08 oe	**1**	
2(a)	Table and pictogram correct 8 12 5 7 Apple  Orange 	**3**	**B1** for 12 and 7 correct **B1** for Apple row correct **B1** for Orange row correct
2(b)	Banana	**1**	
3	(4, 2) (3, 4)	**2**	**B1** for each or for two correct points plotted
4(a)	21	**1**	
4(b)	–5.5	**1**	
5(a)	18.2 to 19	**2**	**B1** for 9.1 to 9.5 [cm] seen or **M1** for *their* distance in cm × 2
5(b)	071 to 075	**1**	
6	15	**2**	**M1** for $250 \times \frac{1.5}{100} \times 4$ oe
7	8.15	**2**	**B1** for answer figs 815 or for 0.85 seen or 900 seen
8	145	**3**	**M1** for (5 – 2) × 180 oe **M1** for *their* 540 – (110 + 125 + 65 + 95)
9(a)	14 17	**1**	
9(b)	$3n + 2$ oe final answer	**2**	**B1** for $3n + k$ oe seen or for $jn + 2$ oe seen $j \neq 0$
9(c)	12	**3**	**M1** for substitution of 20 into *their* $(3n + 2)$ or for 62 seen or for 38 seen **M1** for *their* $(3k + 2) = 100$ – *their* 62

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Question	Answer	Marks	Partial Marks
10	$\frac{40}{71}$	**3**	**B2** for 15 : 40 : 16 oe seen or for 40 : 71 or **M1** for attempt to equate number of blue in the two ratios or for 71 seen or for $\frac{r}{g}=\frac{15}{16}$ soi
11(a)	Acceptable bisector of $\angle PSR$ with correct arcs	**2**	**B1** for acceptable bisector with no/incorrect arcs or for short bisector with arcs
11(b)	Correct region shaded.	**1**	**FT** *their* **(a)** dependent on attempt at angle bisector
12(a)	[0].00204 or 2.04×10^{-3} cao	**1**	
12(b)	4, 60 and 0.4 seen **and** final answer 300	**2**	**B1** for two of 4, 60 and 0.4 seen
13(a)	144	**2**	**B1** for $(3 \times 4)^2$ or $3^2 \times 4^2$ or better
13(b)	Irrational number in range $4.5 \leqslant n \leqslant 5.5$	**1**	
14(a)	2×10^{-4}, 0.002, 2×10^{-2}, 2000	**1**	
14(b)	[a =] 2 [b =] 8	**2**	**B1** for each or **SC1** for $a = 20$ and $b = 9$
15	18	**2**	**B1** for $k = 2$ if $y = k(x-1)^2$ used or **M1** for $\frac{32}{(5-1)^2}=\frac{y}{(-2-1)^2}$ or **M1FT** for $y =$ *their* $k \times (-2-1)^2$
16(a)	Tangent drawn at $x = -1$	**B1**	
	–3 to –2	**B1**	Dep on close attempt at tangent at $x = -1$
16(b)	–3.9 to –3.8 0 3.8 to 3.9	**3**	**B1** for each If 0 scored, **M1** for line $y = 2$ drawn at least from (–1, 2) to (1, 2) If 0 scored, **SC1** for answers (–3.9 to –3.8, 2) and (0, 2) and (3.8 to 3.9, 2)
17(a)	Square Rhombus	**1**	

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Question	Answer	Marks	Partial Marks
17(b)	Two correct pairs of angles from $\angle AXC = \angle BXD$, $\angle CAX = \angle DBX$ and $\angle ACX = \angle BDX$ with correct reasons **and** $AX = BX$ with correct reason **and** ASA stated e.g. $AX = BX$ given $\angle AXC = \angle BXD$ [vertically] opposite $\angle CAX = \angle DBX$ alternate [angles] [Congruent] ASA	**3**	**B2** for two pairs of equal sides/angles with correct reasons or **B1** for one pair of equal sides/angles with correct reason or for two appropriate pairs with no or incorrect reasons
18	$\frac{x+7}{3}$ oe final answer	**2**	**B1** for x = $3y - 7$ or $y + 7 = 3x$ or $\frac{y}{3} = x - \frac{7}{3}$
19(a)(i)	{a, e, f, g, h, i, j}	**1**	
19(a)(ii)	6	**1**	
19(b)	$A \cap C \cap B'$ oe	**1**	
20(a)	35	**1**	
20(b)	100	**2**	**B1** for $\angle OAB = 55$ or $\angle OBA = 55$
21(a)	$(4x - 3)(x + 2)$ final answer	**2**	**M1** for brackets giving two out of three terms correct in a quadratic expression or for $4x(x + 2) - 3(x + 2)$ seen or for $x(4x - 3) + 2(4x - 3)$ seen
21(b)	$\frac{x^3}{4}$ final answer	**2**	**B1** for answer $\frac{x^3}{k}$ or $\frac{x^k}{4}$ or for $\left(\frac{x^6}{16}\right)^{\frac{1}{2}}$ seen or for $\left(\frac{4}{x^3}\right)^{-1}$ seen
22(a)	$\frac{7}{9}$ oe	**1**	
22(b)	$\frac{1}{9}$ or $\frac{8}{72}$ oe nfww	**3**	**M2** for $\frac{3}{9}\times\frac{2}{8}+\frac{2}{9}\times\frac{1}{8}$ oe or **M1** for $\frac{3}{9}\times\frac{2}{8}$ or $\frac{2}{9}\times\frac{1}{8}$ seen If 0 scored, **SC1** for answer $\frac{13}{81}$ or $\frac{8}{81}$
23	7π final answer	**2**	**M1** for $\frac{360-80}{360}\times\pi\times3^2$ oe If 0 scored, **SC1** for answer 2π

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Question	Answer	Marks	Partial Marks
24(a)	–2	**3**	**M1** for $2 - 5x = 3(3x + 10)$ or better **M1** for $2 - 30 = 9x + 5x$ or better
24(b)	$\frac{x+13}{(x-2)(2x+1)}$ or $\frac{x+13}{2x^2-3x-2}$ final answer	**3**	**B1** for $3(2x + 1) - 5(x - 2)$ oe isw **B1** for denominator $(x - 2)(2x + 1)$ oe isw
25(a)	$\frac{5}{2}\mathbf{c}$ oe final answer	**1**	
25(b)	$4\mathbf{a} + \frac{3}{2}\mathbf{c}$ or $\frac{8\mathbf{a}+3\mathbf{c}}{2}$ final answer	**2**	**B1** for final answer $4\mathbf{a} + k\mathbf{c}$ oe or $k\mathbf{a} + 1.5\mathbf{c}$ oe , $k \neq 0$ or $\overrightarrow{AP} = 3\mathbf{a}$ soi or **M1** for a correct route along the lines of the diagram using the given vertex letters
25(c)	1 : 10 oe	**1**	