Cambridge O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/21**

Paper 2 **May/June 2018**

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.

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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).

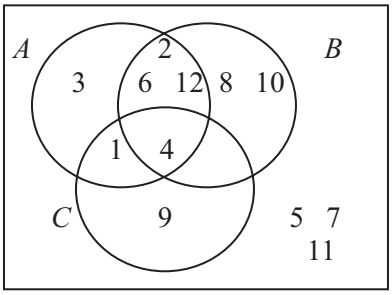
GENERIC MARKING PRINCIPLE 6:

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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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

Question	Answer	Marks	Partial Marks
1(a)	$(P \cup Q)'$ or $P' \cap Q'$	**1**	
1(b)(i)		**2**	**B1** for 8 or more correct
1(b)(ii)	4	**1**	FT *their* Venn diagram provided no repeated elements
1(b)(iii)	1	**1**	FT *their* Venn diagram provided no repeated elements
1(b)(iv)	$A' \cap B \cap C$	**1**	
1(c)(i)	$2^2 \times 3^3 \times 5$	**2**	**M1** for at least two correct stages in factor tree or ladder method
1(c)(ii)	$2 \times 3^2 \times 5$	**2**	**B1** for 90 seen or $2^2 \times 3^4 \times 5^2$
2(a)	109.95 or 109.96	**3**	**B2** for 2109.9(..) or 2110 or **M2** for $2000\left(1+\frac{1.8}{100}\right)^3 - 2000$ oe or **M1** for $2000\left(1+\frac{1.8}{100}\right)^3$ oe
2(b)	600	**3**	**M1** for 54×12 (=648) or $\frac{54}{1.08}$ (=50) oe **M1** for $\left(\frac{100+8}{100}\right)x = \textit{their}648$ oe soi or $\textit{their}50 \times 12$
3(a)	9.5 oe	**2**	**M1** for $4p - 2p = 7 + 12$ or better

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Question	Answer	Marks	Partial Marks
3(b)	Correct method to eliminate one variable	**M1**	
	$x = 1, y = -3$	**A2**	**A1** for $x = 1$ or $y = -3$ After **A0**, **SC1** for two correct values with no working or two values that satisfy one of the original equations
3(c)	$\frac{m}{2m-1}$ final answer nfww	**3**	**B1** for $m(m + 3)$ **B1** for $(2m – 1)(m + 3)$
3(d)	62.5 oe	**3**	**M2** for $b = \frac{4}{8} \times (5)^3$ oe soi or **B1** for $\frac{4}{8}$ oe or $\left(\frac{5}{2}\right)^3$ oe soi or $b = ka^3$
4(a)	$\frac{1}{6}$ cao	**1**	
4(b)	$\frac{1}{660}$ oe	**2**	**M1** for $\frac{1}{12} \times \frac{1}{11} \times \frac{2}{10}$ oe or **SC1** for $\frac{1}{12} \times \frac{1}{12} \times \frac{2}{12}$ or answer $\frac{1}{864}$ or $\frac{1}{12}, \frac{1}{11}, \frac{2}{10}$
4(c)(i)	$\frac{8}{12}, \frac{8}{11}, \frac{4}{11}, \frac{7}{11}$ oe correctly placed	**2**	**B1** for two correct
4(c)(ii)	$\frac{1}{11}$ oe	**1**	
4(c)(iii)	$\frac{16}{33}$ oe	**2**	**M1** for $\frac{4}{12} \times \frac{8}{11}$ or $\frac{8}{12} \times \frac{4}{11}$ oe
5(a)(i)	$6n – 5$ oe	**2**	**M1** for $6n + k$ oe with $k \neq 0$
5(a)(ii)	256 is not exactly divisible by 6 or 247 in sequence and next one is 253 oe	**1**	
5(b)(i)	$p^2 – 3$ oe	**1**	
5(b)(ii)	$p^2 + 2p + 4$ oe	**1**	
5(c)(i)	Correct drawing	**1**	
5(c)(ii)	28, 40	**2**	**B1** for one correct
5(c)(iii)	$t^2 + 3t$ oe	**2**	**B1** for $t^2 + ...$
6(a)(i)	Correct construction with arcs	**2**	**B1** for correct triangle with arcs missing or arc 6 cm from A or arc 9 cm from B

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Question	Answer	Marks	Partial Marks
6(a)(ii)	77° to 81°	**1**	FT *their* angle *BAC*
6(b)	79875 cao	**2**	**B1** for 225 and 355 seen
6(c)(i)	66° alternate [angles]	**2**	**B1** for 66
6(c)(ii)	79°	**1**	FT 145 – *their* 66
6(c)(iii)	*RQT* *RTQ*	**B1**	
	QT is common oe	**B1**	
	AAS oe	**B1**	Dep on previous B1
7(a)	$15 + [2\times]\ 3x + [2\times]\ \left(\frac{15}{x}\times 3\right)$	**M1**	
	Leading to $\left(15+6x+\frac{90}{x}\right)$ without error	**A1**	
7(b)	5.70 or 2.63 and $6x^2 - 50x + 90$ [= 0] seen	**4**	**B1** for $6x^2 - 50x + 90$ [= 0] oe AND **B2FT** for $\frac{-(-50)\pm\sqrt{(-50)^2-4\times6\times90}}{2\times6}$ or **B1FT** for $\sqrt{(-50)^2-4\times6\times90}$ or $\frac{-(-50)\pm\sqrt{r}}{2\times6}$ After 0, **SC2** for 5.70 or 2.63
7(c)(i)	74.25	**1**	
7(c)(ii)	Correct smooth curve	**2**	**B1FT** for at least 5 points correctly plotted
7(c)(iii)	6.5 to 6.6 2.3 to 2.4	**2**	FT *their* graph **B1FT** for either correct
8(a)	$\begin{pmatrix}0 & -1\\ 1 & 0\end{pmatrix}$	**2**	**B1** for a correct row or column
8(b)	Triangle with vertices at (2, –3) (4, –3) (2,–4)	**1**	
8(c)	Reflection in $y = x$	**2**	**B1** for reflection or $y = x$
8(d)	Rectangle with vertices at (–1, 5) (–1, 6) (2, 6) (2, 5)	**2**	**B1** for *R* translated by $\begin{pmatrix}-2\\ k\end{pmatrix}$ or $\begin{pmatrix}k\\ 3\end{pmatrix}$

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Question	Answer	Marks	Partial Marks
9(a)	9.025 to 9.03	**4**	**M3** for $\frac{70}{360}\times\pi\times8^2-\frac{1}{2}\times8^2\times\sin 70$ or **M1** for $\frac{70}{360}\times\pi\times8^2$ **M1** for $\frac{1}{2}\times8^2\times\sin 70$
9(b)(i)	8 – 8cos 35 oe	**M2**	**M1** for 8cos 35 (= 6.55..)
	1.45 or 1.446 to 1.447 so yes	**A1**	
9(b)(ii)	192	**2**	**B1** for two of 4, 16 and 3 soi or **M1** for $\frac{48\times4x\times24}{16\times x\times1.5}$ oe
10(a)	11 13	**2**	**M1** for $\frac{12}{15}$[×60] oe
10(b)	13.7 or 13.70…	**4**	**B1** for 146° AND **M2** for $\sqrt{12^2+2^2-2\times12\times2\times\cos146}$ or **M1** for $12^2 + 2^2 - 2 \times 12 \times 2 \times \cos 146$ *Alternative* **B1** for 9.95 or 9.948 to 9.949 or 6.71[0...] AND **M2** for $\sqrt{their6.71^2+(their9.94+2)^2}$ or **M1** for *their* $6.71^2 + (their9.94 + 2)^2$
10(c)	3.0 or 3.00 to 3.01	**2**	**M1** for tan .. = $\frac{\text{figs}105}{\text{figs}2}$ oe
11(a)	Correct region indicated	**3**	**B1** for ruled line $x = 1$ **B1** for ruled line $x + y = 5$
11(b)(i)	6.32...	**2**	**M1** for $\sqrt{(5--1)^2+(5-3)^2}$
11(b)(ii)	$y = -3x + 10$ oe	**4**	**B3** for (2, 4) **and** $y = -3x + c$ OR **B2** for $y = -3x + c$ OR **B1** for (2, 4) or $\frac{5-3}{5-(-1)}$ oe and **M1** for $-\frac{1}{their\ 1/3}$