Cambridge O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

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

Paper 2 **October/November 2019**

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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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.

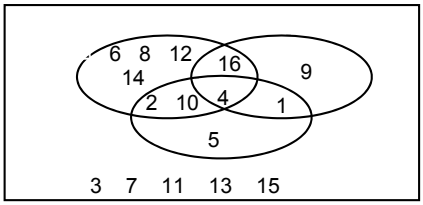
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Abbreviations

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)	2356	**2**	**M1** for product of any three of 15.20, $7\frac{3}{4}$, 5 and 4
1(b)	14	**2**	**M1** for $\frac{25700-22102}{25700}[\times 100]$ or $\frac{22102}{25700}\times 100$ After 0 scored, **SC1** for answer 86
1(c)	375	**3**	**M2** for $\frac{465.75}{1.08\times 1.15}$ oe or **B1** for 1.08 or 1.15 oe seen After 0 scored, **SC1** for answer 379 or 378.7[0] or 378.65 to 378.66
1(d)	601.75 or 601.76	**3**	**M2** for $8500\times\left(1+\frac{3.1}{100}\right)^5$ oe or **M1** for $8500\times\left(1+\frac{3.1}{100}\right)^k$ oe where $k > 1$
2(a)	$y = -1$ oe	**1**	
2(b)	Enlargement Scale factor –3 Centre (–3, 2)	**3**	**B1** for each
2(c)	Correct transformation, vertices (5, –1), (6, –1), (6, –3), (5, –2)	**2**	**B1** for three vertices correct or three correct pairs of coordinates soi
3(a)(i)	6 points plotted correctly	**2**	**B1** for 3, 4 or 5 points plotted correctly
3(a)(ii)	4	**1**	
3(a)(iii)	Positive	**1**	
3(a)(iv)	Ruled line of best fit	**1**	
3(a)(v)	*Their* time for 800 m at 65 s for 400 m	**1**	Strict **FT** their straight line of best fit

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Question	Answer	Marks	Partial Marks
3(b)(i)	$p+10+15+13+q = 50$ oe	**1**	
3(b)(ii)	$142.5p+147.5\times10+152.5\times15+157.5\times13+162.5q=153.6\times50$ oe simplified to $142.5p+162.5q = 1870$	**2**	**B1** for $142.5p$, 147.5×10, 152.5×15, 157.5×13 and $162.5q$ seen or for 153.6×50 seen
3(b)(iii)	Correct method to eliminate one variable	**M1**	
	$[p =]4$ $[q =]8$	**A2**	**A1** for one correct or **B1** only for correct answers without algebraic method
4(a)	–1.8	**1**	
4(b)	Correct smooth curve	**3**	**B2FT** for 8 or 9 points correctly plotted or **B1FT** for 6 or 7 points correctly plotted
4(c)	Tangent drawn at (1, 4.8)	**B1**	Dep on curve drawn between (0, 3) and (2, 5.4)
	1.2 to 1.6	**B1**	Dep on close attempt at tangent
4(d)(i)	Ruled line through (–2, 5) to (2, 3) crossing curve three times	**2**	**B1** for short or unruled line or for two correct coordinates soi
4(d)(ii)	–3.8 to –3.7 0.4 to 0.5 3.3 to 3.4	**2**	**FT** intersection of *their* line with *their* 'curve' **B1FT** for two correct
4(d)(iii)	$A = -25$ $B = 10$	**3**	**B2** for one correct or **M1** for $\frac{8-x}{2} = 3 + 2x - \frac{x^3}{5}$ oe
5(a)(i)	Correctly completed Venn diagram 	**3**	**B2** for Venn diagram with one or two errors, omissions or repeats or for correct Venn diagram with 3, 7, 11, 13, 15 omitted or **B1** for Venn diagram with three or four errors, omissions or repeats or for correct Venn diagram with 3, 7, 11, 13, 15 omitted and one other error, omission or repeat
5(a)(ii)	10	**1**	
5(a)(iii)	2, 4, 10	**1**	**FT** *their* Venn diagram
5(b)(i)	$\frac{1}{8}$ oe	**1**	

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Question	Answer	Marks	Partial Marks
5(b)(ii)	$\frac{1}{40}$ oe	**2**	**M1** for $\frac{k}{16}\times\frac{k-1}{15}$ or **SC1** for answer $\frac{9}{256}$
6(a)	$\frac{3-5v}{v}$ oe final answer	**2**	**M1** for correct first step $v(p+5) = 3$ or better
6(b)	$\frac{x^2-15}{(2x-5)(x-6)}$ or $\frac{x^2-15}{2x^2-17x+30}$ final answer	**3**	**B1** for $x(x–6)+3(2x–5)$ oe soi **B1** for denominator $(2x–5)(x–6)$ oe
6(c)	$[x=]-\frac{3}{10}$ oe	**3**	**M1** for $4x+5 = 2(1–3x)$ soi **M1** for isolating x terms: $4x+6x = 2–5$ or better
6(d)	$5x+15 = 4x^2–2x$	**B1**	
	$4x^2–7x–15[= 0]$ or $15+7x–4x^2[= 0]$	**M1**	
	$(4x+5)(x–3)[= 0]$	**M1**	or for $x=\frac{-(-7)\pm\sqrt{(-7)^2-4\times4\times(-15)}}{2\times4}$
	$[x=]-\frac{5}{4}$ oe, $[x=]3$	**B1**	
7(a)	[0]67.3 or [0]67.29…	**4**	**B3** for $[\angle SPR=]$ 25.3 or 25.29… or **M2** for $[\sin SPR=]\frac{146\sin108}{325}$ or **M1** for $\frac{146}{\sin SPR}=\frac{325}{\sin108}$ oe AND **M1** for *their SPR*+42
7(b)(i)	$[QR^2=]$ $280^2+325^2–2\times280\times325\times\cos38$	**M1**	
	= 201.5… [= 202]	**A2**	**A1** for $[QR^2=]$ 40 607.[…]
7(b)(ii)	2 minutes 12 seconds	**3**	**M2** for $\frac{202}{1000\times5.5}\times60[\times60]$ oe or **M1** for $\frac{\text{figs }202}{\text{figs }5.5}$
8(a)	9300 or 9299 to 9301	**3**	**M2** for $\frac{1}{3}\pi\times16^2\times60-\frac{1}{3}\pi\times12^2\times45$ oe or **M1** for $\frac{1}{3}\pi\times16^2\times60$ or $\frac{1}{3}\pi\times12^2\times45$

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Question	Answer	Marks	Partial Marks
8(b)	$[c^2 =]12^2+45^2$	**M1**	
	$[c =]46.57…$	**A1**	
8(c)	1820 or 1816 to 1819.[0…]	**4**	**B2** for $l = 62.09$ to 62.13 or **M1** for $\sqrt{60^2+16^2}$ oe and **M1** for $\pi\times16\times$*their* $62.1 - \pi\times12\times46.6$ [$+\pi\times12^2$] If 0 scored, **SC1** for $\pi\times12^2$
9(a)(i)	$10 - x$ final answer	**1**	
9(a)(ii)	$12 - x$ final answer	**1**	
9(b)	$\frac{(10-x)(12-x)}{10\times12}=\frac{3}{4}$	**M1**	**FT** *their* algebraic *AR* and *AP*
	$120–12x–10x+x^2$ seen	**M1**	**FT** Correct expansion of *their* brackets
	Correct expansion and rearrangement to $x^2–22x+30 = 0$	**A1**	Dep on correct *AR* and *AP*
9(c)	$\frac{-(-22)\pm\sqrt{(-22)^2-4\times1\times30}}{2\times1}$	**B2**	**B1** for $\sqrt{(-22)^2-4\times1\times30}$ or for $\frac{-(-22)\pm\sqrt{\textit{their}\ 364}}{2\times1}$
	1.46, 20.54	**B1**	
9(d)	27.9 or 27.85 to 27.87…	**2**	**M1** for use of *their* 1.46 to find an area e.g. $1.46(10–1.46)$, $1.46(12–1.46)$, 1.46^2, etc.
10(a)	*AC*=*BD* equal diameters *AB* is common $\angle ABC = \angle BAD = 90°$ angle in semicircle Congruent RHS	**3**	**B1** for correct pair of angles and one correct pair of sides or for two correct pairs of sides **B1** for correct reasons for two pairs of sides/angles
10(b)(i)	124°	**2**	**B1** for $\angle ADB$ or $\angle BCA = 62°$ soi or $\angle AOD = 56°$ soi or $\angle AOB = 124°$ soi

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Question	Answer	Marks	Partial Marks
10(b)(ii)	12.8 or 12.77 to 12.78	**5**	**M4** for $4\times 4\tan\left(\frac{their\ 124}{2}\right)-\frac{their 124}{360}\times\pi\times 4^2$ oe OR **M1** for $DT=4\tan\left(\frac{their 124}{2}\right)$ oe or $OT=4\div\cos\left(\frac{their 124}{2}\right)$ oe **M1** for [area kite =] $4\times$*their DT* oe or $their\ OT\times 4\sin\left(\frac{their 124}{2}\right)$ oe **M1** for $\left[\text{sector area} =\right]\ \frac{their 124}{360}\times\pi\times 4^2$ oe

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