Cambridge O Level

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Cambridge Ordinary Level

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

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)	17.6[0]	**2**	**B1** for 7 (hours) 45 (minutes) or 7.75 (hours) or **M1** for 682 ÷ (5 × *their* 7.75) oe
1(b)	275	**2**	**M1** for $\frac{(100-16)}{100}x = 231$ oe or **SC1** for answer 44
1(c)	259[.00] cao	**3**	**M2** for $\frac{850\times 0.44 - 260}{0.44}$ oe or **M1** for 850 × 0.44 or 260 ÷ 0.44 or (*their* 374 – 260) ÷ 0.44
1(d)	Account B, \$3118.53 and 3112.37 or 1.037[…] seen	**4**	**M1** for [3000 ×] 1.011 × 1.012 × 1.014 oe **M1** for [3000 ×] 1.013^3 oe **A1** for 3112.37 or 3118.53 or 1.037[…] or 1.0395[…]
2(a)	Correct frequency polygon (ruled lines)	**2**	**B1** for 4 or 5 heights correct soi
2(b)	$q = 9$	**B2**	**M1** for [0×p] + 1×14 + 2×15 + 3×7 + 4×q + 5×5 + 6×2 oe
	$p = 17 -$ *their* q	**B1**	**Strict FT** provided q integer with $0 \leqslant q \leqslant 17$
2(c)(i)	Correct labelled pie chart: C[omedy] , D[rama] , H[orror]	**3**	**B2** for correct sectors without labels or incorrect labels or **B1** for one correct sector or 90, 54 and 72 seen
2(c)(ii)	$\frac{21}{60}, \frac{7}{20}, \frac{126}{360}$, 0.35 or 35%	**1**	
2(c)(iii)	$\frac{210}{3540}$ oe	**2**	**M1** for $\frac{15}{60}\times\frac{14}{59}$[×2] or **SC1** for $\left(\frac{15}{60}\right)^2$ or answer $\frac{1}{16}$ oe
3(a)	$x = -1.8$ oe	**2**	**M1** for $3x + 7x = 12 - 30$ or $-7x - 3x = 30 - 12$ or better

Question	Answer	Marks	Partial Marks
3(b)	Correct method to eliminate one variable	**M1**	
	$x = 2.5$ oe $y = -6$	**A2**	**A1** for either $x = 2.5$ or $y = -6$ After **A0**, **SC1** for a pair of values that satisfy either equation or for correct answers with no working
3(c)	$\frac{v}{2v+3}$ final answer nfww	**3**	**B1** for $v(v-8)$ seen **B1** for $(2v+3)(v-8)$ seen
4(a)(i)	Correctly completed Venn diagram	**1**	
4(a)(ii)	36	**1**	
4(a)(iii)	13	**1**	**FT** n($A \cup B$) from *their* Venn diagram provided no repeated elements in sets A and B
4(a)(iv)	1, 4, 6, 9, 12, 18	**1**	**FT** provided no repeated elements in sets A and B
4(b)	1540	**2**	**B1** for answer 1540k, where k is an integer or for $2 \times 2 \times 5 \times 7$ **and** $2 \times 5 \times 7 \times 11$ seen or 2, 2, 5, 7, 11
4(c)	18	**2**	**B1** for answer 2, 3, 6 or 9 or for $2 \times 3 \times 3 \times 5 \times 5$ **and** $2 \times 3 \times 3 \times 17$ seen or 2, 3, 3 with 25 and 17
5(a)(i)	25.7 or 25.72 to 25.73	**2**	**M1** for $\frac{134}{360} \times 2 \times \pi \times 11$ oe
5(a)(ii)	4.3[0] or 4.298…	**2**	**M1** for $\cos\left(\frac{134}{2}\right) = \frac{d}{11}$ or $\sin\left(\frac{180-134}{2}\right) = \frac{d}{11}$ oe
5(b)(i)	$\frac{1}{3}\pi r^2 \times 9.5 = 115$ or $r^2 = \frac{3V}{\pi h}$ or better	**M1**	Correct substitution into volume equation or correct rearrangement
	$r = 3.39[9\ldots]$ or $3.40[00]$	**A1**	
5(b)(ii)	108 or 107.7 to 107.8	**3**	**M2** for $\pi \times 3.4 \times \sqrt{9.5^2 + 3.4^2}$ or **M1** for $l^2 = 9.5^2 + 3.4^2$ soi

Question	Answer	Marks	Partial Marks
6(a)	5.5, 5.5 oe	**1**	Both correct
6(b)	Correct smooth curve	**3**	**B2FT** for 8 or 9 points correctly plotted or **B1FT** for 6 or 7 points correctly plotted
6(c)	tangent drawn at $x = 1.5$	**B1**	Dependent on a curve drawn between $x = 1$ and $x = 2$
	–1.7 to –1.3	**B1**	
6(d)	$x \leqslant 0.6$ to 0.9 $x \geqslant 5.1$ to 5.4	**2**	**B1** for one correct or **SC1** for answers reversed
6(e)(i)	Ruled line passing through (0, 3) and (4, 0) crossing curve twice	**2**	**B1** for short or unruled line or for two correct points plotted
6(e)(ii)	$A = –9$, $B = –4$	**2**	**B1** for either correct or $2x^2 – 9x – 4$ [=0] or **M1** for $\left(\frac{x^2}{2} – 3x + 2\right) = \frac{12 – 3x}{4}$ oe After 0, **SC1** for $A = –9.2$ to –8.8 and $B = –4.2$ to –3.8
7(a)	$\sin CAB = \frac{3.7 \sin 42}{2.8}$ OR $C\hat{A}B = \sin^{-1}\left(\frac{3.7 \sin 42}{2.8}\right)$ OR $\frac{\sin CAB}{3.7} = \frac{\sin 42}{2.8}$ **and** sin=0.88[42...]	**M2**	**M1** for $\frac{3.7}{\sin CAB} = \frac{2.8}{\sin 42}$ oe
	$C\hat{A}B = 62.15$[4…]	**A1**	
7(b)	[0]17.2°	**2**	**M1** for 135 + 62.2 – 180 oe

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Question	Answer	Marks	Partial Marks
7(c)	10.5 to 10.6	**4**	**B3** for 4.05 to 4.06 OR **M2** for $\sqrt{2.8^2 + 3.7^2 - 2\times 2.8\times 3.7\times\cos(180-42-62.2)}$ oe or **M1** for $2.8^2 + 3.7^2 - 2\times 2.8\times 3.7\times\cos(180-42-62.2)$ oe OR **M2** for $\frac{2.8\sin(180-42-62.2)}{\sin 42}$ oe or **M1** for $\frac{\sin(180-42-62.2)}{AB}=\frac{\sin 42}{2.8}$ oe OR **M2** for $\frac{3.7\sin(180-42-62.2)}{\sin 62.2}$ oe or **M1** for $\frac{\sin(180-42-62.2)}{AB}=\frac{\sin 62.2}{3.7}$ oe OR **B1** for $A\hat{C}B = 75.8$
8(a)	$\angle BAX = \angle OCX$, alternate [angles] $\angle ABX = \angle COX$, alternate [angles] $\angle AXB = \angle CXO$, [vertically] opposite	**3**	**B1** for two correct pairs of angles **B1** for correct reason for one pair of angles
8(b)(i)	4**c**	**1**	
8(b)(ii)	9**a** – 6**c** or 3(3**a** – 2**c**)	**2**	**B1** for answer 9**a** + *k***c** or *k***a** – 6**c** ($k \neq 0$)
8(c)(i)	3 : 2	**2**	**B1** for $3k$: $2k$, where k is an integer
8(c)(ii)	9 : 4	**1**	**FT** *their* 3^2 : *their* 2^2
8(c)(iii)	4 : 5	**1**	
9(a)(i)	$\frac{12\times 60}{x}$ oe	**1**	
9(a)(ii)	$\frac{8\times 60}{x-1.5}$ oe	**1**	After 0 in (i) and (ii), **SC1** for $\frac{8}{x-1.5}$ and (a)(i) $\frac{12}{x}$

Question	Answer	Marks	Partial Marks
9(a)(iii)	$\frac{720}{x}+\frac{480}{x-1.5}=110$ oe	**M1**	**FT** *their* (a)(i) and (a)(ii) if functions of x
	$\frac{720(x-1.5)+480x}{x(x-1.5)}=110$ or $720(x-1.5)+480x=110x(x-1.5)$	**M1**	**Dep** on equation of form $\frac{c}{px}+\frac{d}{qx+r}=e$ where p, q, r, c, d and e are numeric and non zero, AND either correctly uses a common denominator for *their* fractions or correctly removes *their* fractions
	$720x-1080+480x=110x^2-165x$	**A1**	Correct elimination of correct brackets
	With a minimum of one intermediate step establishes $22x^2-273x+216=0$	**A1**	
9(a)(iv)	$\frac{-(-273)\pm\sqrt{(-273)^2-4\times22\times216}}{2\times22}$ or $\frac{273}{44}\pm\sqrt{\left(\frac{273}{44}\right)^2-\left(\frac{216}{22}\right)}$	**B2**	**B1** for $\sqrt{(-273)^2-4\times22\times216}$ or for $\frac{-(-273)\pm\sqrt{their55521}}{2\times22}$ or for $\left(x-\frac{273}{44}\right)^2$
	11.56 and 0.85 cao	**B1**	
9(b)	1 hour 59 minutes cao	**3**	**M2** for $\frac{20}{their11.56-1.5}[\times60]$ oe or **M1** for *their*$11.56-1.5$ or for $\frac{20}{their\ x}$
10(a)	$(-1, \frac{1}{2})$ or $(-1, 0.5)$ cao	**1**	
10(b)	$\frac{1}{2}$ oe	**1**	

Question	Answer	Marks	Partial Marks
10(c)	[Gradient of BC =] $\frac{-8}{4}$	**M1**	Alternative 1: **M1** for $\frac{1}{2} \times m_{BC} = -1$ or $m_{BC} = -\frac{1}{0.5}$ oe leading to $m_{BC} = -2$ **A1** for gradient of $BC = \frac{-8}{4} = -2$ hence perpendicular Alternative 2: **M1** for $\overrightarrow{AB} = \begin{pmatrix} 6 \\ 3 \end{pmatrix}$ oe and $\overrightarrow{AC} = \begin{pmatrix} 10 \\ -5 \end{pmatrix}$ oe **A1** for $(4^2+8^2) + (6^2+3^2) = (10^2+5^2)$ hence perpendicular
	$\frac{1}{2} \times \frac{-8}{4} = -1$ hence perpendicular	**A1**	
10(d)	(0, –9)	**2**	**B1** for one value correct or **M1** for $\begin{pmatrix} -4 \\ -1 \end{pmatrix} + \begin{pmatrix} 4 \\ -8 \end{pmatrix}$ oe or $\begin{pmatrix} 6 \\ -6 \end{pmatrix} + \begin{pmatrix} -6 \\ -3 \end{pmatrix}$ oe
10(e)	31.3 or 31.30…	**4**	**M3** for $[2\times]\left(\sqrt{3^2+6^2} + \sqrt{4^2+(-8)^2}\right)$ oe or **M2** for $\sqrt{4^2+(-8)^2}$ oe or $\sqrt{3^2+6^2}$ oe or **M1** for $4^2 + (-8)^2$ oe or $3^2 + 6^2$ oe

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