Cambridge International Examinations
Cambridge Ordinary Level

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

Paper 2 **October/November 2016**

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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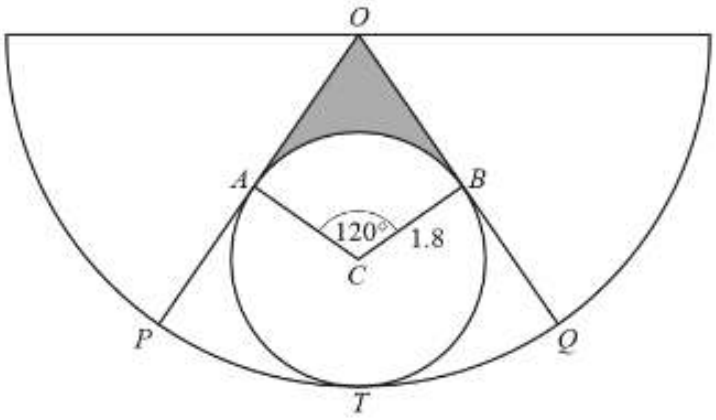
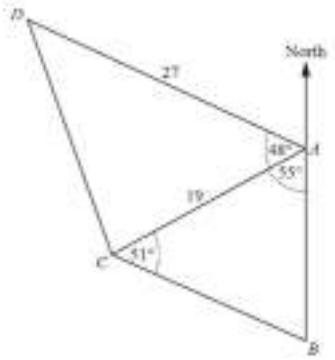
Question	Answers	Mark	Part marks
1 (a) (i)	133	1	
(ii)	20	1	
(iii)	1900	2	**M1** for $\frac{1995}{105}$
(b)	22 22 or 10 22 pm	1	
(c)	6600 final answer	2	**M1** for $\frac{1000000}{4\times38}$ oe
(d)	8.93	2	**B1** for 100.5 or 11.25 used
2 (a)	2.71 or 2.711[…]	1	
(b)	$3p(\ 3p - 2q\ )$ final answer	1	
(c)	$9a^2 + 6ab + b^2$ final answer	1	
(d)	$\frac{6t+1}{(2t+1)(3t+1)}$ or $\frac{6t+1}{6t^2+5t+1}$ final answer	3	**M1** for $4(\ 3t + 1\ ) - 3(\ 2t + 1\ )$ soi **B1** for $6t + 1$ seen as numerator or $(2t + 1)(3t + 1)$ oe seen as denominator
(e)	–3, –4, –5	2	**M1** for $n < -\frac{9}{4}$ oe Or **SC1** for answer –3, –4, –5, –6 or answer –2, –3, –4, –5
(f)	50	3	**B1** for $x + (x - 12) + (2x - 24) = 112$ oe and **B1** for $x = 37$ or **M1** correct evaluation of amount for Chuku using *their* expression and *their x*
3 (a) (i)	[$\angle PBQ$ =] $180 - 2a$ or $2(90 - a)$	1	
(ii)	[$\angle APD$ =] $90 - a$	1	
(iii)	[$\angle DAP$ =] $2a$	1	
(iv)	[$\angle ADP$ =] $90 - a$	1	
(b) (i)	3.3	1	
(ii)	30.4[19..]	2	**M1** for $4.7 \times \sin 54$ oe

Question	Answers	Mark	Part marks
4 (a)	422 or 423 or 422.4 to 422.6	**2**	**M1** for $\frac{1}{2}\times 4\times\pi\times(9-0.8)^2$ Or **SC1** for answer 508.9 to 509.0…
(b)	440 or 440.0 to 440.2	**5**	**B1** for 8.2 used **B1** for $\frac{2}{3}\pi r^3$ used **M1** for Bowl: $\left[\frac{1}{2}\right]\frac{4}{3}\times\pi\times 9^3-\left[\frac{1}{2}\right]\frac{4}{3}\times\pi\times(9-0.8)^3$ oe **M1** for Cylinder: $\pi\times 3.8^2\times 1.5$
5 (a)	3.76 to 3.77…	**2**	**M1** for $\frac{120}{360}\times 2\times\pi\times 1.8$ oe
(b)	9.99 to 10.01	**3ft**	**FT** *their* (a) + 6.235[…] **M2** for [*OB* =] 1.8 tan 60 oe or **M1** for $\tan 60=\frac{[...]}{1.8}$ oe
(c) (i)	Full calculation, including calculation for *OC* = 3.6 and radius = *TC* + *OC* **AG**	**2**	**M1** for $\cos 60=\frac{1.8}{OC}$ oe or $OC^2 = 1.8^2 + \textit{their } OB^2$
(ii)	2.28	**1ft**	**FT** 5.4 – *their OB*



Question	Answers	Mark	Part marks
6 (a)	[DT =]10.8 or 10.816 to 10.82	2	**M1** for $DT^2 = 6^2 + 9^2$ oe
(b)	139 or 139.2 to 139.3	3	**B1** for $BT = 10$ **M1** for sum of areas of four triangles seen, with at least 3 of the following correct: $\frac{1}{2}\times 8\times 6$, $\frac{1}{2}\times 9\times 6$, $\frac{1}{2}\times 8\times \textit{their } DT$, $\frac{1}{2}\times 9\times \textit{their } BT$
(c)	504	2	**M1** for $9 \times 8 \times 5$ or $\frac{1}{3}\times 9\times 8\times 6$
(d)	50.7° final answer	3	**M1** for finding an acute angle in triangle THG. e.g. $\tan[\ldots] = \frac{11}{9}$ or $\tan[\ldots] = \frac{9}{11}$ **A1** for 50.7[...]° or 39.28 to 39.3°
7 (a)	283°	1	
(b)	055°	1	
(c)	[AB =] 15.4 or 15.36[…]	3	**B1** for $ABC = 74°$ **M1** for $\frac{AB}{\sin 51} = \frac{19}{\sin ABC}$
(d)	[DC =] 20.08 to 20.1	3	**M2** for [DC^2 =] $19^2 + 27^2 - 2 \times 19 \times 27 \times \cos 48$ or **M1** for cosine formula with one error
(e)	Correct working leading to 114 minutes or 1 hour 54 minutes  	4	**M1** for $AX = 19 \times \cos 48$ or for $CX = 19 \times \sin 48$ **M1** for $DX = 27 - \textit{their } AX$ Or for $DX = \sqrt{\textit{their } DC^2 - \textit{their } CX^2}$ **M1** for Time = $216\times\frac{\textit{their } DX}{27}$ oe

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8 (a)	0.2 or 0.21[2…]	**1**	
(b)	Correct axes Correct shape curve through 9 correct points	**B1** **B2**	 **B1ft** for at least 7 correct points plotted
(c)	Clear, correct, tangent drawn 2.2 to 2.5	**M1** **A1**	
(d) (i)	Ruled line from (–0.4, 0) to (2, 3.6)	**1**	
(ii)	$y = 1.5x + 0.6$ or $y = \frac{3}{2}x + \frac{3}{5}$	**2**	**B1** for $m = 1.5$ oe or for $c = 0.6$ oe or for correct equation in a different form
(iii)	0 **and** 3.1 to 3.2	**1ft**	FT intersections of *their* ruled line with *their* curve
(iv)	$A = 2.4$ to 2.6 $B = 1$	**1** **1**	
9 (a)	42	**1**	
(b)	17	**3**	**B2** for 0.9×1.3 or for answer 117 or **B1** for 27×182 or 0.27×182 and **M1** for $\frac{\textit{their}\ 4914 - \textit{their}\ 4200}{\textit{their}\ 4200} \times 100$ oe
(c) (i)	$\frac{(30-y)\times(140+4y)}{100}$ oe isw	**2**	**B1** for $(30 - y)$ or $(140 + 4y)$ soi
(ii)	Forms equation $\frac{(30-y)\times(140+4y)}{100} = 40$ then correct working leading to $y^2 + 5y - 50 = 0$ **AG**	**2**	**B1 FT** for $4200 - 140y + 120y - 4y^2 = 4000$ or better FT equating *their* product from (ii) with 40, eliminating fraction and expanding brackets
(iii)	$y = -10$, 5	**3**	**B2** for $(y + 10)(y - 5)$ or **B1** for $(y + a)(y + b)$ where $ab = -50$ or $a + b = 5$ OR **B1** for $\sqrt{225}$ soi and **B1** for $\frac{-5 \pm \sqrt{\textit{their}\ 225}}{2}$ oe

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(iv)	160 cao	1	
10 (a) (i)	Correct histogram with linear scale on frequency density axis	3	**B2** for all 5 heights correct with axis scaled OR **B1** for at least 3 correct frequency densities soi and **B1** for all 5 bars correct widths
(ii)	39.4[4…]	3	**B1** for use of correct midpoints **M1** for $\frac{\Sigma fx}{135}$
(b) (i)	$\frac{33}{95}$ oe	1	
(ii)	$\frac{48}{95}$ oe	2	**M1** for $\frac{3}{5}\times\frac{8}{19}+\frac{2}{5}\times\frac{12}{19}$ Or **SC1** for answer $\frac{24}{95}$
(iii)	12 cao	1	
(iv)	$\frac{91}{190}$ oe	2	**M1** for $\frac{k}{n}\times\frac{k-1}{n-1}$ where $n > k > 1$
11 (a) (i)	13	2	**M1** for $\sqrt{(-5)^2+12^2}$
(ii) (a)	$[\overrightarrow{BD}=]\overrightarrow{BA}+\overrightarrow{AD}=\begin{pmatrix}6\\-11\end{pmatrix}+\begin{pmatrix}0\\k\end{pmatrix}=\begin{pmatrix}6\\k-11\end{pmatrix}$ **AG**	1	Or $[\overrightarrow{BD}=]\overrightarrow{AD}-\overrightarrow{AB}=\begin{pmatrix}0\\k\end{pmatrix}-\begin{pmatrix}-6\\11\end{pmatrix}=\begin{pmatrix}6\\k-11\end{pmatrix}$
(b)	8.5	2	**M1** for using $2\times\begin{pmatrix}6\\k-11\end{pmatrix}=\begin{pmatrix}12\\-5\end{pmatrix}$
(c)	4.5	1	or **FT** their (i) – their k
(b) (i)	Reflection $x = 0$ or y-axis	1 1	

Question	Answers	Mark	Part marks
(ii) (a)	(3½, 1) , (7, 2), (8, 2)	2	**B1** for 1 or 2 correct pairs of coordinates
(b)	$\begin{pmatrix} -1 & 3 \\ 0 & 1 \end{pmatrix}$	2	**B1** for $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ used or **M1** for $\begin{pmatrix} a & b \\ c & d \end{pmatrix} \times \begin{pmatrix} -\frac{1}{2} & -1 & -2 \\ 1 & 2 & 2 \end{pmatrix} = \begin{pmatrix} 3\frac{1}{2} & 7 & 8 \\ 1 & 2 & 2 \end{pmatrix}$