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Cambridge Ordinary Level

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

Paper 2 **October/November 2016**

MARK SCHEME

Maximum Mark: 100

Published

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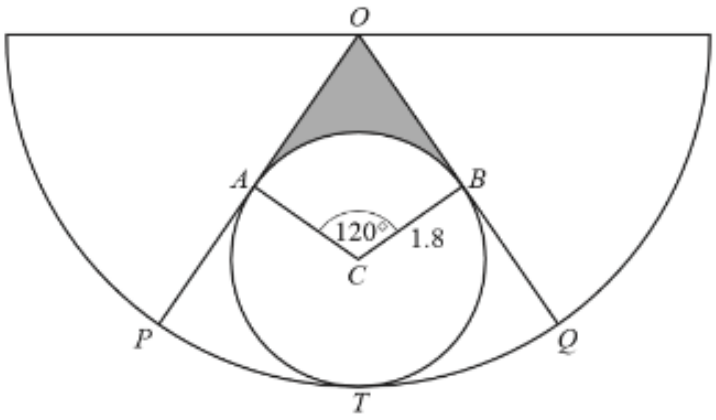
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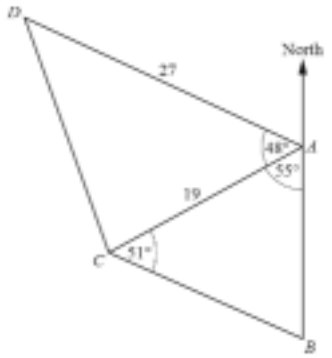
Question	Answers	Mark	Part marks
1 (a) (i)	133	1	
(ii)	20	1	
(iii)	1900	2	**M1** for $\frac{1995}{105}$
(b)	22 22 or 10 22 pm	1	
(c)	6600 final answer	2	**M1** for $\frac{1000000}{4\times38}$ oe
(d)	8.93	2	**B1** for 100.5 or 11.25 used
2 (a)	2.71 or 2.711[…]	1	
(b)	$3p(\ 3p - 2q\ )$ final answer	1	
(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

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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*



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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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Question	Answers	Mark	Part marks
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	

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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 $\begin{pmatrix} a & b \\ c & d \end{pmatrix} \times \begin{pmatrix} -\frac{1}{2} & -1 & -2 \\ 1 & 2 & 2 \end{pmatrix} = \begin{pmatrix} 3\frac{1}{2} & 7 & 8 \\ 1 & 2 & 2 \end{pmatrix}$

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