



MATHEMATICS (SYLLABUS D)

4024/21

Paper 2

October/November 2016

MARK SCHEME

Maximum Mark: 100

Published

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

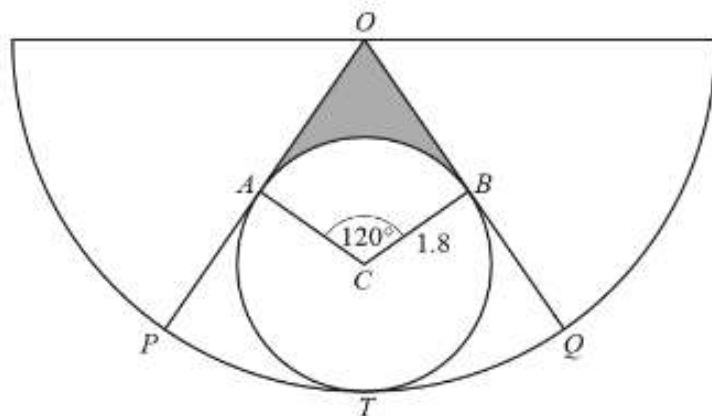
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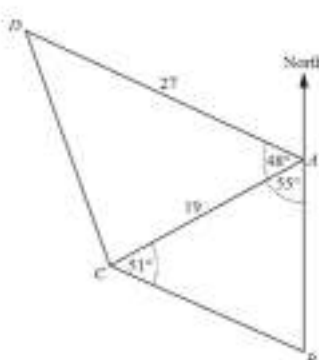
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Question	Answers	Mark	Part marks
1 (a) (i)	133	1	
(ii)	20	1	
(iii)	1900	2	M1 for $\frac{1995}{105}$
(b)	22 22 or 10 22 pm	1	
(c)	6600 final answer	2	M1 for $\frac{1000000}{4 \times 38}$ oe
(d)	8.93	2	B1 for 100.5 or 11.25 used
2 (a)	2.71 or 2.711[...]	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 <i>their</i> expression and <i>their</i> 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 <i>their</i> (a) + 6.235[...] M2 for $[OB =] 1.8 \tan 60$ oe or M1 for $\tan 60 = \frac{[\dots]}{1.8}$ 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 – <i>their</i> 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: $\frac{1}{2} \times 8 \times 6$, $\frac{1}{2} \times 9 \times 6$, $\frac{1}{2} \times 8 \times \text{their } DT$, $\frac{1}{2} \times 9 \times \text{their } BT$
(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 <i>THG</i> . e.g. $\tan [\dots] = \frac{11}{9}$ or $\tan [\dots] = \frac{9}{11}$ A1 for 50.7[...] ^o or 39.28 to 39.3°
7 (a)	283°	1	
(b)	055°	1	
(c)	$[AB =] 15.4$ or 15.36[...]	3	B1 for $ABC = 74^\circ$ 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 $DX = 27 - \text{their } AX$ Or for $DX = \sqrt{\text{their } DC^2 - \text{their } CX^2}$ M1 for Time = $216 \times \frac{\text{their } DX}{27}$ 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 <i>their</i> ruled line with <i>their</i> 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 $\frac{\text{their } 4914 - \text{their } 4200}{\text{their } 4200} \times 100$ 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 <i>their</i> 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 $\frac{-5 \pm \sqrt{\text{their } 225}}{2}$ oe

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Question	Answers	Mark	Part marks
(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 $\frac{\sum fx}{135}$
(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)	$[\overline{BD}] = \overline{BA} + \overline{AD} = \begin{pmatrix} 6 \\ -11 \end{pmatrix} + \begin{pmatrix} 0 \\ k \end{pmatrix} = \begin{pmatrix} 6 \\ k-11 \end{pmatrix}$ AG	1	Or $[\overline{BD}] = \overline{AD} - \overline{AB} = \begin{pmatrix} 0 \\ k \end{pmatrix} - \begin{pmatrix} -6 \\ 11 \end{pmatrix} = \begin{pmatrix} 6 \\ k-11 \end{pmatrix}$
(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)	$(3\frac{1}{2}, 1), (7, 2), (8, 2)$	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 $\begin{pmatrix} a & b \\ c & d \end{pmatrix} \times \begin{pmatrix} -\frac{1}{2} & -1 & -2 \\ 1 & 2 & 2 \end{pmatrix} = \begin{pmatrix} 3\frac{1}{2} & 7 & 8 \\ 1 & 2 & 2 \end{pmatrix}$