
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.

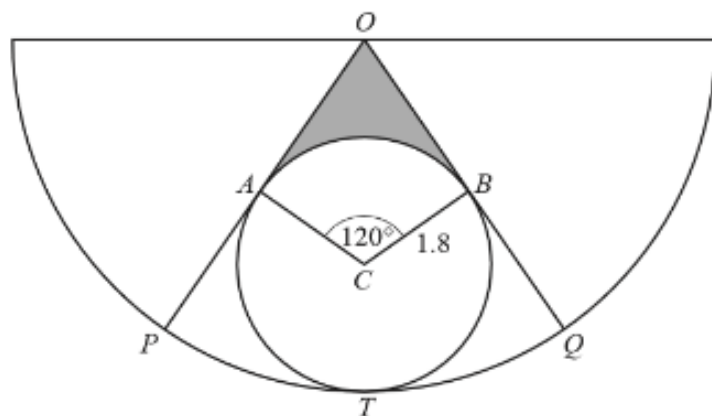
Cambridge will not enter into discussions about these mark schemes.

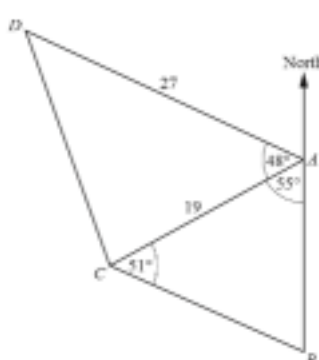
Cambridge is publishing the mark schemes for the October/November 2016 series for most Cambridge IGCSE[®], Cambridge International A and AS Level components and some Cambridge O Level components.

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

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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 = $\frac{[\dots]}{1.8}$ 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 $OC^2 = 1.8^2 + \text{their } OB^2$
(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: $\frac{1}{2} \times 8 \times 6$, $\frac{1}{2} \times 9 \times 6$, $\frac{1}{2} \times 8 \times \text{their } DT$, $\frac{1}{2} \times 9 \times \text{their } BT$
(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

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

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