Cambridge O Level

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Cambridge Ordinary Level

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

Paper 2 **May/June 2016**

MARK SCHEME

Maximum Mark: 100

Published

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Question	Answers	Mark	Part marks
1 (a)	41 472 or 41 470 or 41 500 cao	1	
(b)	\$65 (not from 64.84 rounded)	2	**M1** for $1.05x = 68.25$ soi
(c)	7.50 – 7.60	3	**[M2** for 1.05×1.024 oe] or **M1** for $40500 \times$ *their* 65 [=2 632 500] and **M1** *their* $41\,472 \times 68.25$[= 2 830 464]
2 (a) (i)	$\begin{pmatrix}5\\6\end{pmatrix}$	1	
(ii)	4.47 – 4.473 or 4.5 or $\sqrt{20}$ or $2\sqrt{5}$	2	**M1** for $\sqrt{((\pm4)^2 + (\pm2)^2)}$
(b) (i)	(a) $\frac{1}{2}\mathbf{b} - \mathbf{a}$ or $\frac{1}{2}(\mathbf{b} - 2\mathbf{a})$ or equivalent two term answers final answer	1	
	(b) $\frac{3}{2}\mathbf{b} - 3\mathbf{a}$ or $3(\frac{1}{2}\mathbf{b} - \mathbf{a})$ or $\frac{3\mathbf{b} - 6\mathbf{a}}{2}$ or equivalent two term answers final answer	1	
(ii)	3 : 1 cao	1	Dependent on correct (b)(i)(a) and (b)(i)(b)
3 (a) (i)	1.64 or $1\frac{16}{25}$	2	**M1** for $\frac{0\times7 + 1\times5 + 2\times6 + 3\times4 + 4\times3}{7+5+6+4+3}$
(ii)	2	1	
(iii)	0	1	
(b)	appropriate reason	1	
(c)	$\frac{1}{30}$ cao	2	**M1** for $\frac{5}{25} \times \frac{4}{24}$ oe
(d)	Correct bar chart with axes labelled	2	**B1** if only one error (eg incorrect height, scales missing / incorrect, inconsistent bar widths, or 4 correct bars)
(e)	0 0 1 3 4	1	
4 (a) (i)	Correct triangle with arcs shown	2	**B1** for correct triangle with no arcs or triangle with one side correct length with arcs or triangle with $BC = 7$ and $AC = 12$ with arcs (reflection)
(ii)	104 to 108	1	

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Question	Answers	Mark	Part marks
(b)	150^o	**2**	**M1** for $180 - (360 \div 12)$ or $(180 \times (12-2)) \div 12$
(c) (i)	110^o	**1**	
(ii)	165^o	**2ft**	ft $\frac{3}{2} \times$ *their p* provided $p < 120$ and $p \neq 90$ **B1** for 30, 15 or 75 seen
(d)	$\frac{27}{4}x^2$ final answer	**3**	EITHER **B2** for $\frac{1}{2}(6x+3x)\frac{3x}{2}$ oe or **B1** for $PQ = 3x$ OR **B1** for $3x^2$ (area of small trapezium) **B1** for their $3x^2 \times \left(\frac{3}{2}\right)^2$ oe OR If $AB = x$ used **SC2** for $\frac{27}{16}x^2$ or **SC1** for $\frac{27}{16}$
5 (a)	$4x^2(2y-3x^3)$ final answer	**1**	
(b)	$x = 6.5$ or $\frac{13}{2}$ or $6\frac{1}{2}$	**2**	**M1** for $4x - 2x - 10 = 3$ or better
(c)	$y > -2.6$ or $y > -\frac{13}{5}$ or $y > -2\frac{3}{5}$ final answer	**2**	**M1** for $-5y < 20 - 7$ oe or better Or SC1 for 2.6 or – 2.6 oe seen
(d) (i)	EITHER Width = $\frac{18-4x}{2}$ oe $\frac{18-4x}{2} \times 2x = 10$ oe OR Width = $\frac{10}{2x}$ oe $4x + \frac{20}{2x} = 18$ oe	**M1** **A1**	isw
(ii)	3.85 and 0.65 cao	**3**	**B2** for 3.850 to 3.851 and 0.649 to 0.650 or one correct answer or 3.9 and 0.6 Or if in form $\frac{p \pm \sqrt{q}}{r}$ or $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ **B1** for $p = 9$ and $r = 4$ or $q = 41$

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Question	Answers	Mark	Part marks
(iii)	6.35 to 6.45 or – 6.45 to – 6.35 oe	1	
6 (a) (i)	(a) 10	1	
	(b) 9	1	
	(c) 3,5,7,11	1	
(ii)	$\frac{4}{11}$ oe isw	1ft	ft from *their* (a)(i)(c)
(b) (i)	$\begin{pmatrix} 8 & 0 \\ 3 & 1 \end{pmatrix}$ final answer	2	**B1** for 3 correct elements
(ii)	$\frac{1}{4}\begin{pmatrix} 1 & -2 \\ 1 & 2 \end{pmatrix}$ oe isw	2	**B1** for $k\begin{pmatrix} 1 & -2 \\ 1 & 2 \end{pmatrix}$ or $\frac{1}{4}\begin{pmatrix} a & b \\ c & d \end{pmatrix}$
	SECTION B		
7 (a)	58, 88, 104, 113, 118	1	
(b)	Correct cumulative frequency graph Tolerance $\frac{1}{2}$ small square for plots	3	**B2** for at least 6 correct plots **B1** for at least 3 correct plots If 0 **SC2** for consistent horizontal translation to the left of all points or **SC1** for consistent horizontal translation to the left of all points with one slip
(c) (i)	30 < their answer ⩽ 31	1ft	
(ii)	53 ⩽ their answer ⩽ 55	1ft	
(d)	Correct graph through (10, 6) (25, 30) (34, 60) (44, 90) (60, 120)	3	**B2** for at least 4 correct points plotted **B1** for at least 2 correct points plotted
(e)	garage A 44 to 48 104/2.6 = 40 garage B at 38 to 44	B1 B1 B1	 Dep on 2nd B1; an answer of 40 needs to be confirmed by checking graph
8 (a)	0.5	1	
(b)	Correct graph with smooth curve	2	**B1** for at least 4 correct points
(c)	Tangent drawn and gradient = 2.3 to 3.0	2	**B1** for tangent drawn at $x = 4$ or **B1** for gradient 2.3 to 3.0
(d) (i)	Correct method to eliminate y and reaching the given equation without error including at least one intermediate line	1	

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(ii)	2.3 to 2.4 dep on line drawn	2	**B1** for $2x + y = 6$ drawn
(e) (i)	$\frac{1}{3}$ or 0.33..	1	
(ii)	Tangent gradient roughly $\frac{1}{3}$	1	
(iii)	$y = \frac{1}{3}x + k$ oe where $0 < k < 0.25$	2ft	Ft from their e(i) **B1** for $\frac{1}{3}x + k$ oe where $0 < k < 0.25$ or $y = \frac{1}{3}x + k$ oe (any k outside range)
9 (a)	173.8 to 174 m	3	**B1** for 9 and 115 soi **M1** for $\frac{AB}{\sin 115} = \frac{30}{\sin 9}$ or better
(b)	51.4 to 51.5	4	**B3** for 38.5 to 38.6 or **M2** for $\cos DFE = \frac{75^2 + 180^2 - 130^2}{2 \times 75 \times 180}$ or **M1** for $130^2 = 75^2 + 180^2 - 2 \times 75 \times 180 \cos F$
(c) (i)	188 to 189	1	
(ii)	169 to 170.2 km / h	2	**M1** for 15 × *their* 188 seen
(iii)	15.67 to 16.0	2	**M1** for $\frac{90}{2\pi}$ (= 14.3)
10 (a)	$a = 3$ $b = 5$	2	**B1** for one correct
(b)	$\begin{pmatrix} -6 \\ 3 \end{pmatrix}$ or $3\begin{pmatrix} -2 \\ 1 \end{pmatrix}$	1	
(c)	Reflection , $y = x$	2	**B1** for reflection or **B1** for $y = x$ only
(d)	Enlargement, Scale factor – 2, centre (– 4, 2)	3	**B1** for enlargement / negative enlargement **B1** for scale factor – 2 **B1** for centre (– 4, 2)
(e)	$\begin{pmatrix} -\frac{1}{2} & 0 \\ 0 & -\frac{1}{2} \end{pmatrix}$ oe	1	

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(f) (i)	$(-h, -g)$	1	
(ii)	Reflection $y = -x$	2	**B1** for reflection or **B1** for $y = -x$ only
11 (a) (i)	5.06 to 5.08	4	**B1** for $r + 3.5$ seen **B1** for $\pi(r + 3.5)^2 - \pi r^2$ or $20\pi(r + 3.5)^2 - 20\pi r^2$ **B1** for $20\pi(r + 3.5)^2 - 20\pi r^2 = 3000$ or better
(ii)	Solid II by 2.5 – 2.6	4	**B3** 11.25 to 11.3 cm or **M1** for $\frac{1}{3} \times \pi r^2 \times 2r = 3000$ or better and **M1** for $r^3 = \frac{3000 \times 3}{2 \times \pi}$ (= 1432)
(b)	630 to 632	4	**M1** for $\frac{1}{2} \times 8 \times 8 \times \sin 60$ or $\frac{1}{2} \times 8 \times \sqrt{48}$ oe **M1** for 8×24 soi or 192 soi **M1** for $3 \times 8 \times 24 + 2 \times$ *their* (triangle area)

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