Cambridge O Level

Cambridge International Examinations
Cambridge Ordinary Level

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

Paper 2 **May/June 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)	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 × *their* 65 [=2 632 500] and **M1** *their* 41 472 × 68.25[= 2 830 464]
2 (a) (i)	$\begin{pmatrix}5\\6\end{pmatrix}$	1	
(ii)	4.47 – 4.473 or 4.5 or √20 or 2√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	

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 $q = 41$

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	

Question	Answers	Mark	Part marks
(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	

Question	Answers	Mark	Part marks
(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)