UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS GCE Ordinary Level

MARK SCHEME for the October/November 2011 question paper for the guidance of teachers

4024 MATHEMATICS (SYLLABUS D)

4024/21 Paper 2, maximum raw mark 100

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.

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Abbreviations

cao correct answer only cso correct solution only

dep dependent

ft follow through after error isw ignore subsequent working

oe or equivalent SC Special Case

www without wrong working

soi seen or implied

Qu	Answers	Mark	Part marks
1	(a) 3.64	2	M1 for 10tan20 oe
	(b) 8.24 – 8.28	2ft	M1 for 10(tan50 – tan20) oe
	(c) 24.2, 24.3	3ft	M1 for $(PC =)$ $\frac{10}{\cos 20}$ oe $(= 10.64)$ and M1 for their (a) + 10 + their PC
2	(a) $0 - \frac{7}{3}$ oe isw	2	B1 for one correct
	(b) $x = 1$ $y = -\frac{1}{2}$ oe (c) $\frac{6p + 23}{(p-2)(2p+3)}$ final Ans	3	B2 for one correct www or M1 for reaching such as hx = 11, $11x = k$, or py = -22, $44y = qM1 for \frac{5(2p+3)-4(p-2)}{(p-2)(2p+3)} soi and$
	(d) $\frac{q+1}{2q-1}$ final Ans	3	(p-2)(2p+3) A1 for numerator $10p+15-4p+8$, condoning one sign error, and correct denominator seen at some stage B1 for $(q-1)(q+1)$ seen and
	2q-1	3	B1 for $(2q-1)(q-1)$ seen and B1 for $(2q-1)(q-1)$ seen
3	(a) 60 alternate angles	1	
	(b) (i) 130	1	
	(ii) 310	1	
	(iii) 250	1ft	ft 360 – (their (a) + 50) or their (b)(ii) – their (a)
	(c) (i) Triangles equiangular	1	
	(ii) 51	3	M2 for $\frac{TQ}{85 - TQ} = \frac{3}{2}$ oe or
			M1 for $\frac{TQ}{TR} = \frac{3}{2}$ oe

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4	(a) (i) $\frac{1}{5}$ oe	1	
	(ii) 1 oe	1	
	(b) (i) Correct completion	2	B1 after up to 3 errors
	(ii) (a) 0	1ft	ft from their table
	(b) $\frac{6}{25}$ oe	1ft	Both fts dep on at least B1 scored in (b)(i)
	(c) $\frac{1}{25}$	2	B1 for $5 \times 5 \times 5$ soi
5	(a) Convincing explanation	1	
	(b) (i) $4(\pi)$	1	
	(ii) $\frac{3}{4}$	2ft	B1 for 3π
	$\frac{\mathbf{n}}{4}$		
	(c) (i) 75.4	2	M1 for $\frac{60}{360} \times \pi \times (\text{their } r)^2$
	(ii) 45.7	3	M1 for $\frac{1}{2} \times 6 \times 6 \times \sin 60$ or $\frac{1}{2} \times \pi \times 3 \times 3$ and M1 for their 75.4 – their $\frac{1}{2} \times 6 \times 6 \times \sin 60$ – their $\frac{1}{2} \times \pi \times 3 \times 3$ evaluated
6	(a) (i) 3:5	1	
	(ii) 9 600	1	
	(iii) 20 000	2	M1 for ÷ figs 1125 oe
	(b) (i) 252.48	1	
	(ii) 110.8(0)	2	M1 for $395 + kx = 3054.20$ soi
	(iii) 33.4	2	M1 for ÷ figs 2395 soi
7	(a) (i) Congruency case complete www	3	D1 for common angle of 60 and S1 for $AP=BQ=CR$ or $AR=BP=CQ$
	(ii) (a) $\frac{16}{25}$ oe	1	
	(b) $\frac{3}{25}$ oe	1	

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		<u> </u>	1
	(b) (i) Angle in a semicircle oe	1	
	(ii) Equal arcs or equal chords subtend equal angles at the circumference	2	B1 for $AB = BC$
	(iii) (a) 45	1	
	(b) 135	1ft	ft 3 × their (a)
	(iv) 98	2	B1 for an angle correctly identified as 37°, 53° or 127°
8	(a) 8 correct plots joined	2	P1 for at least 5 correct plots joined
	(b) 5.5 – 7.5	2	M1 for a correct tangent
	(c) (i) Correct line	2	L1 for correct freehand line or a ruled line with gradient – 1 or intercept 2
	(ii) 1.3	1ft	
	(iii) $B = 4$ $C = 5$	3	B2 for one correct www or
			M1 for $2x - \frac{5}{2x} = 2 - x$ soi
	(d) (i) Convincing demonstration	1	
	(ii) Correct completion of graph	1	
9	(a) 122 working seen www	4	M1 for $\frac{\sin ABC}{11} = \frac{\sin 25}{5.5}$ and further M1 for $\sin ABC = \frac{11\sin 25}{5.5}$ soi and A1 for 58 or
			B1 for 180 – their 58
	(b) (i) Correct equation derived www	3	M2 for $(12^2) = x^2 + (5+x)^2 - 2x(5+x)\cos 120$ or M1 for $(12^2) = x^2 + (5+x)^2 + 2x(5+x)\cos 120$
	(ii) 4.276 and –9.276 final answer	4	B3 for one correct or both not or wrongly corrected or B1 for $p = -15$ and $r = 6$ and B1 for $q = 1653$ or $\sqrt{q} = 40.657$ or B1 for $\left(x + \frac{5}{2}\right)^{(2)}$ and B1 for $\frac{551}{12} = 45.916$ or 6.776

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	(iii)	93	1ft	ft from their positive root in (ii)
10	(a) Cor	rect histogram	3	H2 for at least 4 correct columns or H1 for 1 correct column
				For wrong or no vertical scale award SC2 for all heights correct and all widths correct SC1 for all heights correct or all widths correct
	(b) (i)	35 65 100 128	1	
	(ii)	Correct curve	3	P2 for 7 correct ft plots or PC2 for 4 correct ft plots and curve or P1 for 4 correct ft plots
	(c) (i)	(51)	1ft	
	(ii)	(10)	2ft	B1 for reading from the graph at 105
	(d) (16.	5)	2ft	B1 for reading from the graph at 30
11	(a) (i)	(a) (-2,3)	1	
		(b) (-3,2)	1ft	
		(c) (-3,2)	2	B1 for one coordinate correct
	(ii)	$ \begin{pmatrix} \mathbf{a} & \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} $	1	
		(b) M _y	1	
	(b) (i)	5	1	
	(ii)	5	2	B1 for $\sqrt{(4-7)^2 + (4-8)^2}$
	(iii)	(a) (0, 2)	2	M1 for appropriate perpendicular bisectors
		(b) 307	1	