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 –7/3 oe isw	2	**B1** for one correct
	(b) $x = 1$ $y = -½$ oe	3	**B2** for one correct www or **M1** for reaching such as $hx = 11$, $11x = k$, or $py = –22$, $44y = q$
	(c) $\frac{6p+23}{(p-2)(2p+3)}$ final Ans	3	**M1** for $\frac{5(2p+3)-4(p-2)}{(p-2)(2p+3)}$ soi and **A1** for numerator $10p$ +15 – $4p$ + 8, condoning one sign error, and correct denominator seen at some stage
	(d) $\frac{q+1}{2q-1}$ final Ans	3	**B1** for $(q – 1)(q + 1)$ 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

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
	(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**	

	(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 37º, 53º or 127º
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) $B = 4 \quad C = 5$	**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

	(iii) 93	**1ft**	ft from their positive root in **(ii)**
10	**(a)** Correct 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) (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**	