UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

4024 MATHEMATICS (SYLLABUS D)

4024/22 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

SECTION A

Qu.	Answers	Mark	Comments
1	**(a) (i)** $\frac{1}{10x}$ cao	1	
	(ii) $\frac{11x-12}{x(x-3)}$ final answer	2	M1 for $\frac{4(x-3)+7x}{x(x-3)}$
	(b) (i) ¼ or 0.25	1	
	(ii) $c = 2$ cao $d = 1.5$ oe	2	If 0, B1 for $\left(f^{-1}(x)=\right)\frac{4x+3}{2}$
	(iii) g = ½ or 0.5	2	M1 for $\frac{2g-3}{4} = -g$
2	**(a) (i)** $c = \frac{2A}{h} - d$ or $\frac{2A-hd}{h}$ final answer	2	M1 for $c + d = \frac{2A}{h}$ or $\frac{1}{2}hc = A - \frac{1}{2}hd$ oe or SC1 for $c = \frac{A}{\frac{1}{2}h} - d$
	(ii) 3	1	
	(b) (i) 102	2	M1 for 31.5 and 19.5 used
	(ii) 322	3	M2 for (32.5 × 20.5)–(25.5 × 13.5) or M1 for (32.5 × 20.5) or (25.5 × 13.5)
3	**(a)** $\frac{1}{3}$	1	
	(b) (i) $\frac{1}{20}$	2	M1 for $\frac{1}{6}\times\frac{3}{5}\times\frac{2}{4}$ seen
	(ii) $\frac{3}{20}$	2	SC1 for $\frac{5}{36}$ M1 for $\left(\frac{3}{6}\times\frac{2}{5}\times\frac{1}{4}\right)+\left(\frac{3}{6}\times\frac{2}{5}\times\frac{2}{4}\right)$ seen

4	**(a) (i)** $(u_n) = 3n + 1$ oe	1	
	(ii) 61	1ft	ft their u_n with $n = 20$
	(b) (i) $(v_n) = 17 - 2n$ oe	1	
	(ii) (k =) 49 cao	1	
5	**(a)** 11 30 cao	1	
	(b) 39 minutes	1	
	(c) 8 km	1	
	(d) 24 km/h	1	
	(e) park and shopping centre	1	
	(f) Salim and 9 minutes	2	B1 for 12 27 or 1 hour 12 minutes seen or 1.2 hours or 72 minutes or for line from (11.15,0) to (12.15,15)
6	**(a)** (£)1350	1	
	(b) (£)225	1ft	ft their **(a)** 6
	(c) 108°	1ft	ft $\frac{405}{\text{their}\mathbf{(a)}} \times 360$ or $\frac{405}{\text{their}\mathbf{(b)}} \times 60$
	(d) (£)300	2	SC1 for 120° or £450 seen.
	(e) (£)199.80	2	B1 for (£)70.20 or M1 for $(1 - 0.26) \times 270$ oe
	(f) 9(%)	3	M2 for figs $\frac{3645}{405}$ or $\frac{11745}{405}$ or $\frac{28755}{405}$ seen SC1 for 81 or 324 seen
	(g) (£)250	2	M1 for 108 % 270 soi
7	**(a) (i)** 2	1	
	(ii) (a) $\mathbf{q} - \mathbf{r}$	1	
	(b) $2\mathbf{p} - \mathbf{q} - \mathbf{r}$	1	
	(c) $1\frac{1}{2}\mathbf{p} - \mathbf{r}$	1	
	(d) $\frac{1}{2}\mathbf{p} - \mathbf{q} + \frac{1}{2}\mathbf{r}$	1	
	(b) (i) 45°	1	
	(ii) 95°	1ft	ft 140 – their **(b)(i)**
	(iii) 80°	1ft	ft 125 – their **(b)(i)**

SECTION B

8	**(a) (i)** $\begin{pmatrix} 3 & 2 \\ 1 & 4 \end{pmatrix}$	2	B1 for 3 correct terms
	(ii) $\begin{pmatrix} -1 & -2 \\ 1.5 & 2.5 \end{pmatrix}$ or $\frac{1}{2}\begin{pmatrix} -2 & -4 \\ 3 & 5 \end{pmatrix}$	2	B1 for $k\begin{pmatrix} -2 & -4 \\ 3 & 5 \end{pmatrix}$ k ½ or ½ × (2 × 2 matrix)
	(b) (i) Reflection	1	
	$y = 1$	1	
	(ii) Enlargement	1	
	Scale factor ½ Centre (–5,0)	1	
	(iii) (–2 , 3) (–4 , 5) (–4 , 7)	2	B1 for 2 correct vertices or for $\begin{pmatrix} -2 & -4 & -4 \\ 3 & 5 & 7 \end{pmatrix}$
	(iv) Rotation	1	
	90^o anticlockwise about (0,0)	1	
9	**(a)** –5, –6	1	
	(b) All points plotted correctly <u>and</u> a smooth curve – generous quadratic	2ft	B1 for 5 or more points correct ft from their table
	(c) (i) x = –2.2 to –2.35 and 1.65 to 1.85	1	
	(ii) –6.4 $mv < -6.0$	1	
	(iii) 8 to 10	2	M1 for tangent
	(d) (i) $2x^2 + 4x – 3x – 6 = 1 – 2x$ leading to $2x^2 + 3x – 7 = 0$	1	
	(ii) x = 1.27, –2.77	4	B3 for one solution or x = 1.26 to 1.3 **<u>and</u>** –2.76 to –2.8 or if in form $\frac{p \pm (or + or-)\sqrt{q}}{r}$ B1 for p = –3, r = 4 B1 for q = 65 or $\sqrt{q}$ = 8.06

10	**(a) (i)** $74.95 \rightarrow 75.05$	1	
	(ii) $336.5 \rightarrow 337.5$	3	M1 for $250^2 + 300^2 \pm 2 \times 250 \times 300\cos 75$ M1 for $\sqrt{152500 - 150000\cos 75}\left(= \sqrt{113677}\right)$
	(iii) $44.2 \rightarrow 44.3$	3	M2 for $\sin\theta = \dfrac{300\sin 75}{\text{their}337}$ SC1 for $(C\hat{S}B =)\ 45.7 \rightarrow 45.8$ seen
	(b) (i) $241 \rightarrow 241.5$	2	M1 for $\cos 15 = \dfrac{DB}{250}$ oe
	(ii) $12050 - 12100$	2ft	B1 for $\frac{1}{2} \times 200 \times 241 \times \sin 30$ ft $50 \times$ their **(b)(i)**
	(iii) 225	1	
11	**(a)** $\dfrac{7\pi r^2 H}{9}$	3	B1 for $\dfrac{2\pi r^2 H}{3}$ and B1 for $\dfrac{\pi r^2 H}{9}$
	(b) (i) $\sqrt{15^2 + 10^2} = 18(.0)$	2	M1 for $15^2 + 10^2$
	(ii) $62.8 \rightarrow 62.9$ or 20π	2	M1 for $2 \times \pi \times 10$
	(iii) $\theta = \dfrac{62.8 \times 360}{36\pi} = 200^\circ$	2	M1 for $\dfrac{\theta}{360} \times \pi \times 18 \times 2$ = their **(ii)**
	(iv) $2760 \rightarrow 2770$	3	M1 for $\dfrac{200}{360} \times \pi \times 18^2 (= 565.5)$ M1 for $30 \times$ their **(ii)** (= 1884)
12	**(a)** 220, 288, 312, 320	1	
	(b) (i) 7 correct plots and smooth ogive	3	B2 for 5 or 6 correct plots and smooth ogive or B1 for 5 or 6 correct plots
	(ii) (a) $83 \rightarrow 85$	1ft	ft from their graph
	(b) $13.5 \rightarrow 16.5$	2	M1 for readings at 80 and 240 seen
	(c) 15 to 19%	2	SC1 for $48 \rightarrow 60$ or $81 \rightarrow 85$ seen
	(iii) (a) 76 cao	1	
	(b) 25% cao	1	
	(c) More pupils took longer (so) previous test was probably harder	1	