UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2012 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
soi	seen or implied

SECTION A

Qu	Answers	Mark	Part marks
1 (a)	pentagon	1	
(b)	$x \leqslant 5$ oe $x + y \leqslant 6$ oe	1 1	After 0 + 0, **C1** for x ... 5 oe **and** $x + y$ ... 6 oe with incorrect (in)equalities for "...".
(c)	line passing through (5, 0) and (8, 3)	1	
(d)	–1 cao	1	
2 (a)	$x = \frac{3}{5}$ oe	2	**M1** for $14x + 2 – 4x – 8$ (= 0) or better
(b)	$y = \pm 9$	1	
(c) (i)	$h(h + 6) = 33.25$ Rearranging correctly to give $4h^2 + 24h – 133 = 0$	**M1** **A1**	
(ii)	$h = 3.5$ oe and –9.5 oe	3	Using $\frac{p \pm (or + or-)\sqrt{q}}{r}$ **B1** for $p = –24$ and $r = 8$ (or 2×4) **B1** for $q = 24^2 – 4 \times 4 \times (–133)$, or 2704 or $\sqrt{q} = 52$ Using factors **B2** for $(2h – 7)(2h + 19)$ (= 0) or **B1** for $(2h$ ... $7)(2h$ ... $19)$ (= 0) where ... are not both the correct signs
(iii)	9.5 cm or *their* (positive h) + 6	1 ft	

3	**(a)**	36 minutes cao	1	
	(b)	5 km/h cao	1	
	(c)	\$5.2(0)	2	**M1** for 85% = 4.42 oe
	(d)	Horizontal line from (1800, 4) to (2000, 4)	1	
		Line from (2000, 4) to (2030, 2.5) or ft from (*their* 2000, 4) to ((*their* 2000) + 30, 2.5)	1 ft	
	(e)	20 30 or (*their* 2000) + 30	1 ft	
4	**(a)**	279° to 283°	1	
	(b)	*Y* correctly positioned with two correct construction arcs	2	**M1** for correctly positioned *Y* with one correct construction arc, or with no construction arcs or **M1** for *Y* **above** *WX* **and** two correct construction arcs
	(c)	*Z* on a bearing of 072° from *W* *Z* is due North of *X* 27 to 29 km	1 1 1	
5	**(a) (i)**	25, 9	1	
	(ii)	7.15 to 7.25	1	
	(iii)	1.1 to 1.3	2	**M1** for 7.75 to 7.85 **and** 6.55 to 6.65 seen
	(iv)	$\frac{22}{60}$ oe, or 0.36 to 0.37, or 36 to 37%	2	**B1** for 22 seen or **C1** for $\frac{38}{60}$ oe
	(b) (i)	5.65 cm	3	**M1** for 3.5 × 4 + 4.5 × 15 + 5.5 × 20 + 6.5 × 13 + 7.5 × 5 + 8.5 × 3 i.e. 14 + 67.5 + 110 + 84.5 + 37.5 + 25.5 (= 339) **M1** for ÷ 60 (or 4 + ...)
	(ii)	35%	2	**B1** for 65%, or for 21 seen
6	**(a) (i)**	4, 8, 10, 14	1	
	(ii)	1	1	
	(iii)	3 out of {2, 5, 7, 11, 13}	1	
	(b)	Correct shading	1	
	(c)	16	2	**B1** for Venn Diagram and 17 in $(G \cup S)'$

7	(a) (i)	$\mathbf{b} - \mathbf{a}$	1	
	(ii)	$\frac{1}{2}(\mathbf{b} + \mathbf{c})$	1	
	(iii)	$\frac{1}{4}\mathbf{b} + \frac{1}{2}\mathbf{c}$ **or** *their* (aii) $- \frac{1}{4}\mathbf{b}$	2 ft	**B1** for one correct term or for $-\frac{1}{4}\mathbf{b} - \frac{1}{2}\mathbf{c}$
	(b) (i)	$\frac{2}{5}\mathbf{b} - \frac{2}{5}\mathbf{a}$	1	
	(ii)	2 : 3 oe	1	
	(iii)	$\frac{3}{5}\mathbf{a} - \frac{7}{20}\mathbf{b} - \mathbf{c}$	2	**B1** for one correct term, or for $\mathbf{c} + \frac{7}{20}\mathbf{b} - \frac{3}{5}\mathbf{a}$

SECTION B

8	(a) (i)	128 to 128.4	3	**M2** for $\cos B = \frac{20^2 + 2^2 - 21.3^2}{2 \times 20 \times 2}$ or **M1** for $21.3^2 = 20^2 + 2^2 - 2 \times 20 \times 2 \times \cos B$
	(ii)	14.3 to 14.5	3	**M2** for $\sin((their(\text{ai}) - 90) = \frac{x}{20}$ oe (12.4)
	(b) (i)	29°	1	
	(ii)	9.6 to 9.7	3	**M2** for $CE = \frac{8.6 \times \sin 33}{\sin(their(bi))}$ or **M1** for $\frac{CE}{\sin 33} = \frac{8.6}{\sin(their(bi))}$ oe
	(iii)	11.6 to 11.7	2	**C1** for 78.3 to 78.4 or **B1** for 11.6 to 11.7 or 78.3 to 78.4 seen in working

9 (a) (i)	$\begin{pmatrix} -5 & 0 \\ 1 & 2 \end{pmatrix}$	1	
(ii)	$\begin{pmatrix} 0 & -\frac{1}{3} \\ \frac{1}{2} & \frac{1}{6} \end{pmatrix}$ or $\frac{1}{6}\begin{pmatrix} 0 & -2 \\ 3 & 1 \end{pmatrix}$ seen	2	**M1** for $\begin{pmatrix} 0 & -2 \\ 3 & 1 \end{pmatrix}$ seen, or for attempting to multiply $\frac{1}{6}$ by a 2×2 matrix
(b) (i)	$\begin{pmatrix} 974 \\ 328 \end{pmatrix}$	2	**B1** for one correct value, or for (974 328)
(ii)	Mention of cost **and** (both carpet and underlay)	1	
(c) (i)	*F* correctly positioned	2	**M1** for 2 correct vertices plotted or **C1** for correct reflection in $y = x$
(ii)	*G* correctly positioned	2	**M1** for 2 correct vertices plotted or for 3 correct coordinates calculated
(iii) (a)	4; or –4	1	
(iii) (b)	$m = 1$, $n =$ *their*(c)(iii)(a)	1 ft strict	
10 (a) (i)	686 to 687 cm^2	4	**M1** for using $\frac{300}{360}$ oe **M1** for using $\pi \times 15^2$ **M1** for $\frac{1}{2} \times 15^2 \times \sin 60$ oe (= 97.4278 ...)
(ii)	93.5 to 93.6 cm	2	**M1** for $\frac{300}{360} \times 2 \times \pi \times 15$ (= 78.5398...)
(b)	12.4 cao	2	**B1** for $\frac{1}{2}(15 + 25)h = 248$ oe
(c) (i)	3	1	
(ii)	37.36 to 37.4 cm^2	3	**M1** for 248 + *their*(a)(i) **M1** for division by 5^2 soi (indep)

11	**(a) (i)**	56°	1	
	(ii)	34° or 90 – *their*(a)(i)	1 ft	
	(iii)	62° or (180 – *their*(a)(i))/2	1 ft	
	(iv)	42°	2	**B1** for $A\hat{C}D = 28°$ seen
	(v)	110°	2	**B1** for seeing $D\hat{A}C = 42°$; **or** $A\hat{B}C = 70°$; **or** $A\hat{B}O = 8°$
	(b) (i) (a)	32° alternate (to $P\hat{Q}T$)	1	If 0 + 0, then **C1** for **both** 32° and 116°
	(i) (b)	116° $S\hat{P}Q$ and $P\hat{Q}R$ are allied, interior, adjacent	1	
	(ii)	**Full** line parallel to *PS*, 4 cm away **Full** arc, centre *R*, radius 5 cm	1 1	
	(iii)	Correct region shaded	1 ft	
12	**(a)**	Convincing reason. e.g. The height of the cuboid would then be –2 cm	1	
	(b)	$x^2(8 - x)$ **and** $\frac{4}{3} \times 3 \times (\frac{x}{2})^3$ Correct expansion and simplification to $8x^2 - \frac{x^3}{2}$	**M1** **A1**	
	(c) (i)	58.5	1	
	(ii)	7 correct plots and a smooth curve	3	**B2** for 6 or 7 correct (ft) plots or **B1** for 4 or 5 correct (ft) plots
	(iii)	3.3 to 3.5	2	**B1** for 4.5 to 4.7 seen
	(d)	$4.7 \leqslant x < 5$ (dep on **M1**)	3	**B1** for ($y =$) $27x$ seen or implied **M1** for attempt at drawing correct line