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)

4024/21   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

SECTION A

Qu.		Answers	Mark	Part Marks
1	**(a) (i)**	11	1	
	(ii) (a)	4, 8, 12, 16	1	
	(ii) (b)	x is a multiple of 4	1	
	(b)	21	2	**M1** for $n(P \cup F)' = 12$
2	**(a)**	Option 2 by $9	2	**M1** for $48 \times 2 + 13 \times 6$ or $48 + 13 \times 9$
	(b)	$2700	2	**M1** for 2781 is 103%
3	**(a)**	$(3x - 8y)(3x + 8y)$	1	
	(b)	$x = 2\frac{1}{2}$ or $-5\frac{1}{2}$	3	**M1** for $4 \times x \times (x + 3) = 55$ or better **M1** for $4x^2 + 12x - 55 \ (=0)$ After **M0**, **SC1** for one solution
	(c) (i)	$(x - 1)(x + 2) - 15 = 3(x + 2)$ Correct expansion leading to $x^2 - 2x - 23 = 0$	**M1** **A1**	
	(ii)	$x = 5.9$ or -3.9	3	If $\frac{p + \sqrt{q}}{r}$ **B1** for $p = 2$, $r = 2$ and **B1** for $q = 96$ **B2** for one correct solution or $x = 5.8989\ldots$ and $-3.8989\ldots$ rounded or truncated to 2 or more dp
4	**(a)**	1660	3	**M1** for $\frac{1}{2} \times 10 \times (50 + 35)$ **M1** for 81×10
	(b)	24.7	3	**M1** for $1206 = \pi r^2 - \pi \times 15^2$ **M1** for $r^2 = \frac{1206 + \pi \times 15^2}{\pi}$ $(= 608.9)$
	(c) (i)	$33\frac{1}{3}$, 33.3	1	
	(ii)	$\frac{4}{9}$	2	**B1** for $\left(\frac{10}{15}\right)^2$ oe seen or $\frac{9}{4}$ seen

5	(a)		32°	1	
	(b)		$D\hat{C}B$ is alternate to $F\hat{D}C$	1	
			58–32 = 26	1	
	(c)	(i)	94°	1	
		(ii)	28°	1ft	ft 122 – *their* 94
		(iii)	56°	1	
		(iv)	60°	1	
6	(a)		$\dfrac{1}{2}$	1	
	(b)		$y \geqslant -1$	1	
			$y \leqslant \dfrac{1}{2}x$	1	If 0 scored, **SC1** for both correct, any symbol
	(c)		Correct triangle drawn	2	**M1** for two correct vertices or reflection in $y = 2$ or $x = -2$
	(d)	(i)	2	1	
		(ii)	$(8 , -1)$	1	
		(iii)	12	2ft	**M1** for area of $R = 6$ used
7	(a)	(i)	60°	1	
		(ii)	AOB and OBC are equilateral triangles oe	1	
	(b)	(i)	$\mathbf{b} - \mathbf{a}$	1	
		(ii)	$2\mathbf{b} - \mathbf{a}$	1ft	ft $\mathbf{b}$ + *their* ($\mathbf{b} - \mathbf{a}$) but not $k\mathbf{a}$ or $k\mathbf{b}$
		(iii)	$\dfrac{3}{4}\mathbf{a} + \dfrac{1}{4}\mathbf{b}$	2	**M1** for $\dfrac{1}{4}\overrightarrow{AB}$ or $\dfrac{3}{4}\overrightarrow{BA}$
		(iv)	$\mathbf{b} - \dfrac{1}{2}\mathbf{a}$	1	
		(v)	$\dfrac{3}{4}\mathbf{b} - \dfrac{5}{4}\mathbf{a}$	2	**SC1** for $\dfrac{5}{4}\mathbf{a} - \dfrac{3}{4}\mathbf{b}$

SECTION B

8	(a)	(i)	307°	1	
		(ii)	*B* correctly positioned	1	
			C correctly positioned, with 2 arcs	2	**M1** for *C* correctly positioned
		(iii)	074° ± 3°	1	
	(b)	(i)	30.8	2	**M1** for $\dfrac{72}{360} \times \pi \times 7^2$
		(ii)	22.8	2	**M1** for 8.79(64..) or 8.8 or *their* arc length + 14
		(iii)	Line parallel to *JM* 5 cm away	1	
			Angle bisector of *JK̂L*	1	
		(iv)	Correct shading	1	
9	(a)		54.5 www	3	**M1** for 6 × 10 + 15 × 30 + 29 × 50 + 18 × 70 + 9 × 90 + 3 × 110 **B1** for ÷ by 80
	(b)		50, 68, 77	1	
	(c)		7 correct points plotted and smooth curve	3	**B2** for 7 or 6 correct plots or **B1** for 5 or 4 correct plots
	(d)	(i)	50 to 55	1	
		(ii)	68 to 72 and 38 to 40	**M1**	
			28 to 34	**A1**	
		(iii)	(16 to 17) / 80 oe	2	**M1** for 15 to 17 seen
10	(a)		$x(10-x)^2$	**M1**	
			Correct expansion leading to $x^3 - 20x^2 + 100x$	**A1**	
	(b)	(i)	63, 32	1	
		(ii)	Correct 9 points drawn joined with a smooth curve	3	**B2** for 7, 8 or 9 correct points plotted **B1** for 5 or 6 correct points plotted
	(c)	(i)	147.1 to 150	1	
		(ii)	1.7 – 1.9	1	
			5.1 – 5.3	1	
	(d)		$y = \dfrac{\pi x^3}{6}$ seen or implied	**M1**	
			Attempt at correct curve	**A1**	
			5.6 < *x* < 6	**A1**	

11	(a)	(i)	18.6 to 18.61	2	**M1** for $(AE^2) = 15^2 + 11^2$
		(ii)	11.17 to 11.2	4	**M2** for $\cos D = \dfrac{60.5^2 + 50^2 - 15^2}{2 \times 60.5 \times 50}$ **M1** for implicit form **A1** for $\cos D = 0.981\ldots$
	(b)	(i)	50°	1	
		(ii)	11.76 to 11.8	3ft	**M2** for $FB = \dfrac{11\sin 55}{their \sin 50}$ **M1** for implicit form
		(iii)	51.8 – 51.9 www cao	2	**M1** for $\tan \theta = \dfrac{15}{their 11.8}$ seen
12	(a)	(i)	$\begin{pmatrix} -5 & 6 \\ 0 & -2 \end{pmatrix}$	1	
		(ii)	$\dfrac{1}{6} \begin{pmatrix} 2 & -6 \\ 2 & -3 \end{pmatrix}$ oe isw	2	**M1** for $\dfrac{1}{6} \times$ (2 by 2 matrix) or $\begin{pmatrix} 2 & -6 \\ 2 & -3 \end{pmatrix}$
	(b)	(i)	$m = 1.5$ and $n = 2$	1	
		(ii)	$\begin{pmatrix} 112 \\ 115 \end{pmatrix}$	2	**B1** for 1 element correct in a 2 by 1 or both elements seen
		(iii)	3 Difference in training distance of Mark and Luke	1ft 1	ft difference between their 2 values
	(c)	(i)	138	1	
		(ii)	44	1	
		(iii)	28	1	
		(iv)	football stadium and cafe	1	