

**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

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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 $x = 5.8989\dots$ and $-3.8989\dots$ 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

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5	(a)	32°	1	
	(b)	$D\hat{C}B$ is alternate to $F\hat{D}C$ $58 - 32 = 26$	1 1	
	(c) (i)	94°	1	
	(ii)	28°	1ft	ft 122 – their 94
	(iii)	56°	1	
	(iv)	60°	1	
6	(a)	$\frac{1}{2}$	1	
	(b)	$y \geq -1$ $y \leq \frac{1}{2}x$	1 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)	$\frac{3}{4}\mathbf{a} + \frac{1}{4}\mathbf{b}$	2	M1 for $\frac{1}{4}\overrightarrow{AB}$ or $\frac{3}{4}\overrightarrow{BA}$
	(iv)	$\mathbf{b} - \frac{1}{2}\mathbf{a}$	1	
	(v)	$\frac{3}{4}\mathbf{b} - \frac{5}{4}\mathbf{a}$	2	SC1 for $\frac{5}{4}\mathbf{a} - \frac{3}{4}\mathbf{b}$

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SECTION B

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

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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 $\cos D = \frac{60.5^2 + 50^2 - 15^2}{2 \times 60.5 \times 50}$ M1 for implicit form A1 for $\cos D = 0.981\dots$
	(b) (i)	50°	1	
	(ii)	11.76 to 11.8	3ft	M2 for $FB = \frac{11 \sin 55}{\text{their} \sin 50}$ M1 for implicit form
	(iii)	51.8 – 51.9 www cao	2	M1 for $\tan \theta = \frac{15}{\text{their} 11.8}$ seen
	12	(a) (i)	$\begin{pmatrix} -5 & 6 \\ 0 & -2 \end{pmatrix}$	1
(ii)		$\frac{1}{6} \begin{pmatrix} 2 & -6 \\ 2 & -3 \end{pmatrix}$ oe isw	2	M1 for $\frac{1}{6} \times (2 \text{ by } 2 \text{ matrix})$ 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	