

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)

4024/22

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

Qu	Answers	Mark	Part Marks
1	(a) $(m =) \frac{A - h^2}{4h}$ final ans	3	M1 for $A = 4hm + h^2$ or $\frac{A}{h} = 4m + h$ and (indep.) M1 for $4hm = A - h^2$ or $4m = \frac{A}{h} - h$ or for isolating the term in m after the first M0 .
	(b) $(x - 2y)(3a + 5b)$	2	M1 for $x(3a + 5b) - 2y(3a + 5b)$ or $3a(x - 2y) + 5b(x - 2y)$ or for correct extraction of one common factor at any stage.
	(c) 2 or -1.6	3	C2 for one correct www or M2 for $5x - 1 = \pm 9$ or $5(5x + 8)(x - 2) = 0$ oe or M1 for $(5x - 1)^2 = 81$ soi or for $5x - 1 = 9$
2	(a) 43(.0)	2	M1 for $\sin x = \frac{3.73}{5.47}$ (0.6819) oe
	(b) $(\pm) 2.5(0)$	4	M2 for $5.32^2 + 3.73^2 - 2 \times 5.32 \times 3.73 \times \cos 25$ or M1 for $\cos 25 = \frac{3.73^2 + 5.32^2 - x^2}{2 \times 3.73 \times 5.32}$ or for $5.32^2 + 3.73^2 + 2 \times 5.32 \times 3.73 \times \cos 25$ A1 for 6.246 seen or 8.84
	(c) (i) 245 (ii) 16.7	1 2	B1 for $\tan y = \frac{30}{100}$ or $\frac{100}{30}$ ($y = 73.3$)
3	(a) (i) One line of symmetry (ii) 10 : 1	1 3	B1 for $\pi (r \text{ or } R)^2$ and a further B1 for a valid attempt at an expression or equation involving R and r

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	(b) (i) Convincing explanation	2	B1 for $AOB = 72$ soi or B1 for $ACB = 108$ and conclusion involving 360
	(ii) $7(\pi r)$	2	M1 for $(5 \times) \frac{252}{360} \times 2\pi r$
4	(a) (i) (a) 20	1	
	(b) 25	2	M1 for figs $\frac{60 \times \text{their } 12 - 540}{60 \times \text{their } 12}$ oe
	(ii) 6.25	2	B1 for $\div$ by figs 16
	(b) (i) $63 \times 6 + 4x \leq 500$ or $63 + x \leq 100$ oe isw	1	
	(ii) 93	2	M1 for $63 \times 6 + 4x (<) 500$ or better seen SC1 for answer 30.
	(c) (i) 435	1	
	(ii) 7.2(0)	2	M1 for $\div$ by figs 145
5	(a) $x = 5$ $y = 4$	2	B1 for one correct www or M1 for $\begin{pmatrix} 3x - 11 \\ x + y \end{pmatrix}$ soi
	(b) (i) (a) (a, c)	1	
	(b) (b, d)	1	
	(ii) $\begin{pmatrix} 1 & -3 \\ 3 & -2 \end{pmatrix}$	1	
	(iii) Reflection in x -axis	2	B1 for Reflection only.
6	(a) $\begin{pmatrix} 6 \\ 2 \end{pmatrix}$	1	
	(b) $\frac{1}{3}$ oe isw	1	
	(c) $P = -3$ $Q = 21$	2	M1 for $7P + Q = 0$ or $9P + Q = -6$ or B1 for an equation with $m = \text{their (b)}$ or $c = 7$
	(d) (i) $(18, -5)$	1	
	(ii) $(\pm) 13$	1	

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	(iii) (a) (12, 11)	2	B1 for $(x =) 12$
	(b) $2\overrightarrow{AB}$	1	
7	(a) (i) 27.7	2	M1 for $\frac{1}{2} \times 8 \times 8 \times \sin(\text{their } 60)$ oe
	(ii) Convincing explanation	1	
	(iii) 4.62	2	M1 for $\frac{AF}{\sin 30} = \frac{8}{\sin 120}$ oe such as $\frac{4}{AF} = \cos 30$
	(b) (i) 111	1ft	Accept $4 \times$ their (a)(i) ft
	(ii) 60.3	3ft	M1 for $(VF^2 =) 8^2 - (\text{their (a)(iii)})^2$ A1 for $(VF =) 6.53$ or ft soi SC1 for $\frac{1}{3} \times \text{their (a)(i)} \times \text{their } VF$
	(c) (i) 2 ± 0.01	2	M1 for $\sqrt[3]{}$ of ratio of their volumes soi
	(ii) 8	1	
8	(a) (i) 1240	1	
	(ii) 11 correct plots (and smooth curve)	2	P1 for 7 correct plots (joined.)
	(iii) (4.6)	1ft	ft from their graph at $y = 42$
	(b) (i) 1100	1	
	(ii) Correct line, ruled	2	L1 for freehand line or line with intercept 25 or gradient 3.75
	(c) (4.8)	1ft	
	(d) (i) $6 \leq \text{gradient} \leq 7$ (\$/yr)	2	M1 for correct tangent
	(ii) 3.75 (\$/yr)	1	
	(iii) (2)	1ft	
9	(a) Complete congruency case www	3	R1 for $A = B$ ($= 90$) S1 for $AP = BQ$ or $AB = BC$ <u>stated</u>
	(b) Convincing explanation www	2	C1 for stating $ABP = BCQ$
	(c) (i) Angle in a semicircle	1	
	(ii) B 2	1	

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	(iii) (a) 6	1	
	(b) Convincing explanation www	1	
	(c) 12	1	
	(d) 45	2	B1 for $\frac{1}{2} \times 6 \times$ their (c) or $\frac{1}{2} \times 6 \times 3$ seen
10	(a) (i) $3x$ seen	1	
	(ii) $7 - 2x$ oe seen	2	M1 for $[28 - 2(x + \text{their } 3x)] \div 4$
	(b) (i) $x^2 - 28x + 49 = 0$	2	AG so www M1 for $3x^2 = (7 - 2x)^2$
	(ii) 1.88 26.1	4	B3 One correct or both 1.875 and 26.12 seen or both 1.9 and 26.1 or better seen or B1 for $p = 28$ and $r = 2$ and B1 for $q = 588$ or $\sqrt{q} = 24.248$ B1 for $(x - 14)^{(2)}$ and B1 for 147 or 12.12
	(iii) 1.88 with convincing reason (Accept the accuracy marked in (ii))	2	B1 for 1.88 (or the accuracy marked in (ii))
	(iv) 10.6 or 10.5 cao	1	
11	(a) (i) 7 correct plots and smooth curve	3	P2 for 7 correct plots or P1 for 4 correct plots SC1 for ogive curve SC1 for all heights correct
	(ii) (43)	1ft	ft's dependent on ogive curve
	(iii) (18)	1ft	
	(iv) (26)	1ft	

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	(b) (i) Completion of diagram	2	B1 for two correct probabilities
	(ii) (a) $\frac{1}{11}$	1	
	(b) $\frac{k10}{k11}$ isw	2	B1 for two of the following products correct $\frac{8}{12} \times \frac{7}{11} + \frac{8}{12} \times \frac{4}{11} + \frac{4}{12} \times \frac{8}{11}$
	(iii) $\frac{k}{55k}$ isw	1	