

**MARK SCHEME for the October/November 2011 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

Qu	Answers	Mark	Part marks
1	(a) 3.64	2	M1 for $10\tan 20$ oe
	(b) 8.24 – 8.28	2ft	M1 for $10(\tan 50 - \tan 20)$ oe
	(c) 24.2, 24.3	3ft	M1 for $(PC =) \frac{10}{\cos 20}$ oe (= 10.64) and M1 for their (a) + 10 + their <i>PC</i>
2	(a) 0 $-7/3$ oe isw	2	B1 for one correct
	(b) $x = 1$ $y = -1/2$ oe	3	B2 for one correct www or M1 for reaching such as $hx = 11$, $11x = k$, or $py = -22$, $44y = q$
	(c) $\frac{6p+23}{(p-2)(2p+3)}$ final Ans	3	M1 for $\frac{5(2p+3)-4(p-2)}{(p-2)(2p+3)}$ soi and A1 for numerator $10p+15-4p+8$, condoning one sign error, and correct denominator seen at some stage
	(d) $\frac{q+1}{2q-1}$ final Ans	3	B1 for $(q-1)(q+1)$ seen and B1 for $(2q-1)(q-1)$ seen
3	(a) 60 alternate angles	1	
	(b) (i) 130 (ii) 310 (iii) 250	1	
		1	
		1ft	ft $360 - (\text{their (a)} + 50)$ or their (b)(ii) – their (a)
	(c) (i) Triangles equiangular (ii) 51	1	
		3	M2 for $\frac{TQ}{85-TQ} = \frac{3}{2}$ oe or M1 for $\frac{TQ}{TR} = \frac{3}{2}$ oe

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4	(a) (i) $\frac{1}{5}$ oe	1	
	(ii) 1 oe	1	
	(b) (i) Correct completion	2	B1 after up to 3 errors
	(ii) (a) 0	1ft	ft from their table
	(b) $\frac{6}{25}$ oe	1ft	Both fts dep on at least B1 scored in (b)(i)
(c) $\frac{1}{25}$	2	B1 for $5 \times 5 \times 5$ soi	
5	(a) Convincing explanation	1	
	(b) (i) $4(\pi)$	1	
	(ii) $\frac{3}{4}$	2ft	B1 for 3π
	(c) (i) 75.4	2	M1 for $\frac{60}{360} \times \pi \times (\text{their } r)^2$
(ii) 45.7	3	M1 for $\frac{1}{2} \times 6 \times 6 \times \sin 60$ or $\frac{1}{2} \times \pi \times 3 \times 3$ and M1 for their 75.4 – their $\frac{1}{2} \times 6 \times 6 \times \sin 60$ – their $\frac{1}{2} \times \pi \times 3 \times 3$ evaluated	
6	(a) (i) 3 : 5	1	
	(ii) 9 600	1	
	(iii) 20 000	2	M1 for \div figs 1125 oe
	(b) (i) 252.48	1	
	(ii) 110.8(0)	2	M1 for $395 + kx = 3054.20$ soi
	(iii) 33.4	2	M1 for \div figs 2395 soi
7	(a) (i) Congruency case complete www	3	D1 for common angle of 60 and S1 for $AP=BQ=CR$ or $AR=BP=CQ$
	(ii) (a) $\frac{16}{25}$ oe	1	
	(b) $\frac{3}{25}$ oe	1	

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	<p>(b) (i) Angle in a semicircle oe</p> <p>(ii) Equal arcs or equal chords subtend equal angles at the circumference</p> <p>(iii) (a) 45</p> <p>(b) 135</p> <p>(iv) 98</p>	<p>1</p> <p>2</p> <p>1</p> <p>1ft</p> <p>2</p>	<p>B1 for $AB = BC$</p> <p>ft $3 \times$ their (a)</p> <p>B1 for an angle correctly identified as 37°, 53° or 127°</p>
8	<p>(a) 8 correct plots joined</p> <p>(b) 5.5 – 7.5</p> <p>(c) (i) Correct line</p> <p>(ii) 1.3</p> <p>(iii) $B = 4$ $C = 5$</p> <p>(d) (i) Convincing demonstration</p> <p>(ii) Correct completion of graph</p>	<p>2</p> <p>2</p> <p>2</p> <p>1ft</p> <p>3</p> <p>1</p> <p>1</p>	<p>P1 for at least 5 correct plots joined</p> <p>M1 for a correct tangent</p> <p>L1 for correct freehand line or a ruled line with gradient -1 or intercept 2</p> <p>B2 for one correct www or</p> <p>M1 for $2x - \frac{5}{2x} = 2 - x$ soi</p> <p>1</p> <p>1</p>
9	<p>(a) 122 working seen www</p> <p>(b) (i) Correct equation derived www</p> <p>(ii) 4.276 and -9.276 final answer</p>	<p>4</p> <p>3</p> <p>4</p>	<p>M1 for $\frac{\sin ABC}{11} = \frac{\sin 25}{5.5}$ and further</p> <p>M1 for $\sin ABC = \frac{11 \sin 25}{5.5}$ soi and</p> <p>A1 for 58 or</p> <p>B1 for $180 -$ their 58</p> <p>M2 for</p> <p>$(12^2) = x^2 + (5 + x)^2 - 2x(5 + x)\cos 120$</p> <p>or</p> <p>M1 for</p> <p>$(12^2) = x^2 + (5 + x)^2 + 2x(5 + x)\cos 120$</p> <p>B3 for one correct or both not or wrongly corrected</p> <p>or</p> <p>B1 for $p = -15$ and $r = 6$ and</p> <p>B1 for $q = 1653$ or $\sqrt{q} = 40.657..$</p> <p>or</p> <p>B1 for $\left(x + \frac{5}{2}\right)^{(2)}$ and</p> <p>B1 for $\frac{551}{12} = 45.916$ or 6.776</p>

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	(iii) 93	1ft	ft from their positive root in (ii)
10	(a) Correct histogram	3	H2 for at least 4 correct columns or H1 for 1 correct column For wrong or no vertical scale award SC2 for all heights correct and all widths correct SC1 for all heights correct or all widths correct
	(b) (i) 35 65 100 128	1	
	(ii) Correct curve	3	P2 for 7 correct ft plots or PC2 for 4 correct ft plots and curve or P1 for 4 correct ft plots
	(c) (i) (51)	1ft	
	(ii) (10)	2ft	B1 for reading from the graph at 105
	(d) (16.5)	2ft	B1 for reading from the graph at 30
11	(a) (i) (a) (-2,3)	1	
	(b) (-3,2)	1ft	
	(c) (-3,2)	2	B1 for one coordinate correct
	(ii) (a) $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$	1	
	(b) M_y	1	
	(b) (i) 5	1	
	(ii) 5	2	B1 for $\sqrt{(4-7)^2 + (4-8)^2}$
	(iii) (a) (0, 2)	2	M1 for appropriate perpendicular bisectors
(b) 307	1		