

**MARK SCHEME for the May/June 2011 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

SECTION A

Qu.	Answers	Mark	Comments
1	(a) (i) $\frac{1}{10x}$ cao	1	
	(ii) $\frac{11x-12}{x(x-3)}$ final answer	2	M1 for $\frac{4(x-3)+7x}{x(x-3)}$
	(b) (i) $\frac{1}{4}$ or 0.25	1	
	(ii) $c = 2$ cao $d = 1.5$ oe	2	If 0, B1 for $(f^{-1}(x)) = \frac{4x+3}{2}$
	(iii) $g = \frac{1}{2}$ or 0.5	2	M1 for $\frac{2g-3}{4} = -g$
2	(a) (i) $c = \frac{2A}{h} - d$ or $\frac{2A-hd}{h}$ final answer	2	M1 for $c + d = \frac{2A}{h}$ or $\frac{1}{2}hc = A - \frac{1}{2}hd$ oe or SC1 for $c = \frac{A}{\frac{1}{2}h} - d$
	(ii) 3	1	
	(b) (i) 102	2	M1 for 31.5 and 19.5 used
	(ii) 322	3	M2 for $(32.5 \times 20.5) - (25.5 \times 13.5)$ or M1 for (32.5×20.5) or (25.5×13.5)
	(a) $\frac{1}{3}$	1	
3	(b) (i) $\frac{1}{20}$	2	M1 for $\frac{1}{6} \times \frac{3}{5} \times \frac{2}{4}$ seen
	(ii) $\frac{3}{20}$	2	SC1 for $\frac{5}{36}$ M1 for $\left(\frac{3}{6} \times \frac{2}{5} \times \frac{1}{4}\right) + \left(\frac{3}{6} \times \frac{2}{5} \times \frac{2}{4}\right)$ seen

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4	(a) (i) $(u_n) = 3n + 1$ oe	1	ft their u_n with $n = 20$
	(ii) 61	1ft	
	(b) (i) $(v_n) = 17 - 2n$ oe	1	
	(ii) $(k =) 49$ cao	1	
5	(a) 11 30 cao	1	B1 for 12 27 or 1 hour 12 minutes seen or 1.2 hours or 72 minutes or for line from (11.15,0) to (12.15,15)
	(b) 39 minutes	1	
	(c) 8 km	1	
	(d) 24 km/h	1	
	(e) park and shopping centre	1	
	(f) Salim and 9 minutes	2	
6	(a) (£)1350	1	ft their (a) 6 ft $\frac{405}{\text{their(a)}} \times 360$ or $\frac{405}{\text{their(b)}} \times 60$ SC1 for 120° or £450 seen. B1 for (£)70.20 or M1 for $(1 - 0.26) \times 270$ oe M2 for figs $\frac{3645}{405}$ or $\frac{11745}{405}$ or $\frac{28755}{405}$ seen SC1 for 81 or 324 seen M1 for 108 % 270 soi
	(b) (£)225	1ft	
	(c) 108°	1ft	
	(d) (£)300	2	
	(e) (£)199.80	2	
	(f) 9(%)	3	
	(g) (£)250	2	
7	(a) (i) 2	1	ft 140 – their (b)(i) ft 125 – their (b)(ii)
	(ii) (a) $q - r$	1	
	(b) $2p - q - r$	1	
	(c) $1 \frac{1}{2} p - r$	1	
	(d) $\frac{1}{2} p - q + \frac{1}{2} r$	1	
	(b) (i) 45°	1	
	(ii) 95°	1ft	
	(iii) 80°	1ft	

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SECTION B

8	(a) (i) $\begin{pmatrix} 3 & 2 \\ 1 & 4 \end{pmatrix}$	2	B1 for 3 correct terms
	(ii) $\begin{pmatrix} -1 & -2 \\ 1.5 & 2.5 \end{pmatrix}$ or $\frac{1}{2}\begin{pmatrix} -2 & -4 \\ 3 & 5 \end{pmatrix}$	2	B1 for $k \begin{pmatrix} -2 & -4 \\ 3 & 5 \end{pmatrix} k = \frac{1}{2}$ or $\frac{1}{2} \times (2 \times 2 \text{ matrix})$
	(b) (i) Reflection $y = 1$	1 1	
	(ii) Enlargement Scale factor $\frac{1}{2}$ Centre $(-5,0)$	1 1	
	(iii) $(-2, 3)$ $(-4, 5)$ $(-4, 7)$	2	B1 for 2 correct vertices or for $\begin{pmatrix} -2 & -4 & -4 \\ 3 & 5 & 7 \end{pmatrix}$
	(iv) Rotation 90° anticlockwise about $(0,0)$	1 1	
9	(a) $-5, -6$	1	
	(b) All points plotted correctly <u>and</u> a smooth curve – generous quadratic	2ft	B1 for 5 or more points correct ft from their table
	(c) (i) $x = -2.2$ to -2.35 and 1.65 to 1.85	1	
	(ii) -6.4 $mv < -6.0$	1	
	(iii) 8 to 10	2	M1 for tangent
	(d) (i) $2x^2 + 4x - 3x - 6 = 1 - 2x$ leading to $2x^2 + 3x - 7 = 0$	1	
(ii) $x = 1.27, -2.77$	4	B3 for one solution or $x = 1.26$ to 1.3 and -2.76 to -2.8 or if in form $\frac{p \pm (or + or -)\sqrt{q}}{r}$ B1 for $p = -3, r = 4$ B1 for $q = 65$ or $\sqrt{q} = 8.06$	

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10	<p>(a) (i) 74.95 → 75.05</p> <p>(ii) 336.5 → 337.5</p> <p>(iii) 44.2 → 44.3</p> <p>(b) (i) 241 → 241.5</p> <p>(ii) 12050 – 12100</p> <p>(iii) 225</p>	<p>1</p> <p>3</p> <p>3</p> <p>2</p> <p>2ft</p> <p>1</p>	<p>M1 for $250^2 + 300^2 \pm 2 \times 250 \times 300 \cos 75$ M1 for $\sqrt{152500 - 150000 \cos 75} (= \sqrt{113677})$</p> <p>M2 for $\sin \theta = \frac{300 \sin 75}{\text{their } 337}$</p> <p>SC1 for $(C\hat{S}B =) 45.7 \rightarrow 45.8$ seen</p> <p>M1 for $\cos 15 = \frac{DB}{250}$ oe</p> <p>B1 for $\frac{1}{2} \times 200 \times 241 \times \sin 30$ ft 50 × their (b)(i)</p>
11	<p>(a) $\frac{7\pi r^2 H}{9}$</p> <p>(b) (i) $\sqrt{15^2 + 10^2} = 18(.0)$</p> <p>(ii) 62.8 → 62.9 or 20π</p> <p>(iii) $\theta = \frac{62.8 \times 360}{36\pi} = 200^\circ$</p> <p>(iv) 2760 → 2770</p>	<p>3</p> <p>2</p> <p>2</p> <p>2</p> <p>3</p>	<p>B1 for $\frac{2\pi r^2 H}{3}$ and B1 for $\frac{\pi r^2 H}{9}$</p> <p>M1 for $15^2 + 10^2$</p> <p>M1 for $2 \times \pi \times 10$</p> <p>M1 for $\frac{\theta}{360} \times \pi \times 18 \times 2 = \text{their (ii)}$</p> <p>M1 for $\frac{200}{360} \times \pi \times 18^2 (= 565.5)$ M1 for $30 \times \text{their (ii)} (= 1884)$</p>
12	<p>(a) 220, 288, 312, 320</p> <p>(b) (i) 7 correct plots and smooth ogive</p> <p>(ii) (a) 83 → 85 (b) 13.5 → 16.5 (c) 15 to 19%</p> <p>(iii) (a) 76 cao (b) 25% cao (c) More pupils took longer (so) previous test was probably harder</p>	<p>1</p> <p>3</p> <p>1ft</p> <p>2</p> <p>2</p> <p>1</p> <p>1</p> <p>1</p>	<p>B2 for 5 or 6 correct plots and smooth ogive or B1 for 5 or 6 correct plots</p> <p>ft from their graph</p> <p>M1 for readings at 80 and 240 seen</p> <p>SC1 for 48 → 60 or 81 → 85 seen</p>