

**MARK SCHEME for the May/June 2010 question paper
for the guidance of teachers**

4024 MATHEMATICS (SYLLABUS D)

4024/22

Paper 22, 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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Section A

Qu	Answers	Mark	Comments
1	<p>(a) (i) $p = 7, q = 2.9(0)$ $r = 0.25$ or $\frac{1}{4}$</p> <p>(ii) \$7.75</p> <p>(b) $0.2 \times 980 (= 196)$ and $24 \times 36 (= 864)$ soi \$80</p> <p>(c) 3.5%</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>B3</p> <p>[8]</p>	<p>Correct method for both parts</p> <p>SC2 for answer of 23.5 or 17.5 SC1 for answer of 117.5 or $763.75 - 650$ soi by 113.75 or 22.75</p>
2	<p>(a) (i) 110</p> <p>(ii) 10</p> <p>(b) (i) $x + 2x - 70 + \text{their } 10 = 180$ oe or $x + 2x + \text{their } 110 + 70 + 120 = 540$ oe 80</p> <p>(ii) 90</p>	<p>B1</p> <p>B1ft</p> <p>M2</p> <p>A1</p> <p>B1ft</p> <p>[6]</p>	<p>120 – their (a)(i) (<u>provided</u> answer > 0)</p> <p>Allow M2 for $2x - y = 70$ and $x + y = 170$ where $y = \widehat{EDA}$ If M0, SC1 for $3x$ soi NB: 80 from wrong working is M0</p> <p>180 – their (a)(ii) – their (b)(i) Or $2 \times \text{their (b)(i)} - 70$ (<u>provided</u> answer > 0)</p>
3	<p>(a) Mercury, Mars, Venus, Earth</p> <p>(b) 3000 or 3×10^3 cao</p> <p>(c) $5.5(12) \times 10^{24}$ isw</p> <p>(d) $\frac{4}{3}\pi (6.4 \times 10^3)^3$ 1.09 to $1.1(0) \times 10^{12}$ isw</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>A1 [5]</p>	
4	<p>(a) $y < 12$ y and $2x$ seen in an equality or an inequality $y > 2x$ oe</p> <p>(b) (i) 16</p> <p>(ii) $d = 9$ or (3, 9)</p>	<p>B1</p> <p>M1</p> <p>A1</p> <p>B1</p> <p>B1 [5]</p>	<p>Condone $4 < y < 12$ and $y \leq 12$ SC1 for $y > x$</p>

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5	(a) (i) $\begin{pmatrix} 930 \\ 1235 \end{pmatrix}$ final answer	B2	
	After B0, column matrix with one correct or row matrix with both correct	B1	
	(ii) Top value – cost of fruit in week 1 Bottom value – cost of fruit in week 2	B1ft	Sum of their two values divided by 100
	(iii) \$21.65	B2	SC1 for either +4M or -4M or + or - $\begin{pmatrix} 24 & 0 \\ -8 & 16 \end{pmatrix}$
	(b) $M = \begin{pmatrix} -6 & 0 \\ 2 & -4 \end{pmatrix}$ oe without fractions	B1	
6	(c) (i) (a) 7	B1	
	(b) {10, 14, 16}	B1	
	(ii) $\frac{3}{16}$	B2	SC1 for $(A \cap B) = \{3, 6, 12\}$ Or $n(A \cap B) = 3$
		[10]	
6	(a) $m = \frac{1}{8}$ $n = 8$	B1	Accept 0.12 or 0.13
	(b) 5 correct central points	B1	Accept $\frac{32}{4}$ or $\frac{8}{1}$ if correctly plotted
	Smooth curve through 5 correct central plots	P2	-1 for each wrong plot -1 wrong scale -2 non-uniform scale
	(c) (i) 3.5 – 3.7 ft from $y = 3$	C1	Lost for ruled or thick lines
	(ii) 2.5 – 2.7 ft from $y = 1.5$	B1	Do not accept embedded answers unless clearly justified on graph
(d) (i) $t = x - 2$	B1		
	(ii) $x = \frac{5}{4}$ or 1.25 final answer	B1	[9] Follow through their expression provided it is linear

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7	(a) (i)	184 (cm ²)	B1	
	(ii)	Tan $\widehat{PSR} = \frac{8}{12}$ $\widehat{PSR} = 33.69$ to 33.7	M1 A1	
	(b) (i)	$\frac{KM}{LM} = \frac{KL}{LN}$ oe 27 (cm)	M1 A1	$\frac{KM}{18} = \frac{15}{10}$ oe
	(ii)	$KN = 15$ cm	B2	After B0, $NM = 12$ seen B1
	(iii)	$\frac{16}{65}$ cao	B2 [9]	B1 for unsimplified equivalents or 0.246...

Section B

Qu	Answers	Mark	Comments
8	(a) $\frac{10}{x}$	B1	<p>Correct removal of the denominators x and $x + 0.5$ All correct – Answer given Must see at least 2 steps from previous line</p> <p>SC1 for 4.7 to 4.72 <u>and</u> -0.2 to -0.22 ww...max 2 marks</p> <p>Their $x + 0.5$ (provided $x > 0$) If 2 positive values allow ft on either</p>
	(b) $\frac{15}{x + 0.5}$	B1	
	(c) their $\frac{10}{x} + 2 +$ their $\frac{15}{x + 0.5} = 7$ oe	B1	
	$5x(x + 0.5) = 10x + 5 + 15x$ $2x^2 - 9x - 2 (= 0)$	M1 A1	
	(d) For numerical $\frac{p \pm (\text{or } + \text{ or } -)\sqrt{q}}{r}$		
	$p = 9$ and $r = 4$	B1	
	$q = 97$ or $\sqrt{q} = 9.848\dots$	B1	
	4.71	B1	
	-0.21	B1	
	(e) (i) 5.2(1)	B1ft	
(ii) $\frac{10}{\text{their } 4.71}$ and $\frac{15}{\text{their } 4.71 + 0.5}$ $0.75 \leq t \leq 0.8$	M1 A1 [12]		
9	(a) 305° cao	B1	<p>After A0, 251.9, 252 SC1</p> <p>Dep on first M1</p> <p>ww 2 marks</p> <p>Their (c)(i) – 55</p> <p>Not 09 30 (pm)</p>
	(b) $20^2 + 17^2 \pm (2) \times 20 \times 17 \cos 50^\circ$ $QL^2 = 20^2 + 17^2 - 2 \times 20 \times 17 \cos 50^\circ$ $15.87 - 15.9$	M1 M1 A2	
	(c) (i) $\frac{\sin \widehat{PLQ}}{20} = \frac{\sin 50}{\text{their } 15.9}$	M1	
	$\sin \widehat{PLQ} = \frac{20 \sin 50}{\text{their } 15.9}$ (= 0.9653)	M1	
	$\widehat{PLQ} = 74.48$ to 74.9	A1ft	
	(ii) (0)19.48 to (0)20	B1ft	
	(d) (i) 2130 or 9 30pm	B1	
	(ii) $\sin 50 = \frac{x}{17}$ or $\sin Q = \frac{x}{QL}$	M1	
	$x = 12.9$ to 13.1 (km)	A1 [12]	

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10	(a)	$n = 4$ 22, 20, 42 $n = 5$ 26, 30, 56	B2	After B0, 4 correct values SC1	
	(b)	(i) $4n + 6$	B1	Accept $2(2n + 3)$ or $4 \times n + 6$	
		(ii) $n^2 + n$	B1	Accept $n(n + 1)$ or $n \times n + n$	
	(c)	$n^2 + 5n + 6$ $(n + 2)(n + 3)$	M1 A1	Adds their expressions for (b)(i) and (b)(ii) Factorises – answer given NB: Alternative complete methods can score M1A1	
	(d)	156	B1		
	(e)	(i)	$((k + 2)(k + 3) = 306)$ $k^2 + 5k + 6 = 306$ $k^2 + 5k - 300 = 0$	M1 A1	
(ii)		15 -20	B1 B1	SC1 for -15 and 20	
(iii)		66	B1ft[12]	Their positive integer k substituted into their (b)(i)	
11	(a)	(i)	Correct scales and Correct widths (2, 2, 5, 5, 10) Correct heights (6, 9, 8.4, 5.6, 4)	SW1 H2	3 or 4 correct heights H1
		(ii)	21 or 20	B1	
		(iii)	$\frac{5}{7}$ cao	B1	
	(iv)	$\frac{132}{870}$, $\frac{22k}{145k}$ or 0.15(0) to 0.152	B2	SC1 for $\frac{132}{900}$, $\frac{11k}{75k}$ or 0.147 or $\frac{12 \times 11}{30 \times 29}$ or $\frac{132}{870}$ seen	
	(b)	(i)	$\frac{7}{60}$ cao	B1	
		(ii)	60	B2	After B0, 35% = 21 seen SC1
(iii)		8	B2	SC1 for either 15, 21 and 7 seen or 48° or 13 $\frac{1}{3}$ % seen	

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12	(a) (i) 15	P2	After P0, $\sqrt{9^2 + 12^2}$ P1
	(ii) 678 – 679 (cm ²)	S2	After S0, $\pi \times 9 \times$ their 15 + $\pi \times 9^2$ S1
	(iii) 1017 – 1020 (cm ³)	V2	After V0, $\frac{1}{3} \times \pi \times 9^2 \times 12$ V1
	(b) (i) 4 cm	B1	
	(ii) 10 cm	B1	
	(iii) 18.8 – 18.9 (cm)	C2	After C0, $\pi \times 3 \times 2$ C1
	(iv) 979 – 983 (cm ³)	W2	After W0, $\frac{26}{27} \times$ their 1018 or [12] their 1018 – $\frac{1}{3} \pi 3^2 \times$ their 4 W1