

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

4024 MATHEMATICS (SYLLABUS D)

4024/21

Paper 21, 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	(a) $f(7) = 1$ as final answer	B1	Forms an equation in t and attempts to solve
	(b) $\frac{t-2}{5} = t$	M1	
	$t = -\frac{1}{2}$	A1	
	(c) Attempt to make x the subject $f^{-1}(x) = 5x + 2$	M1 A1 [5]	
2	(a) $\frac{66-48}{48} (\times 100)$	M1	Accept -2.8
	37.5%	A1	
	(b) 130% oe soi	M1	
	$\frac{19.5}{1.3}$ o.e	M1	
	(\$) 15	A1	
	(c) (i) \$88	B1	
(ii) \$79.20 \$2.8(0) cao	B1√ft B1 [8]		
3	(a) Rectangle 13 cm by 8 cm	B1	to cross rectangle across rectangle No need to shade – but must be correct Dep on correct P and Q
	(b) (i) Constructs perpendicular bisector of ZY Arc of circle radius 9 centre X	B1 B1	
	(ii) Labels the correct region	B1	
	(c) (i) P and Q correctly positioned	B1ft	
	(ii) (a) 42 ± 1 m cao	B1	
	(b) $107^\circ (\pm 2^\circ)$ cao	B1 [7]	

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4	(a) $\frac{4(2x-1)-3(x+3)}{(x+3)(2x-1)}$	M1	Single fraction. Brackets not essential. Multiplies the first fraction by $(2x-1)$ and the second fraction by $(x+3)$ Multiplies out the numerator with at least 1 pair of terms correct s.o.i. or used SC1 for both 3.0 to 3.1 and -1.7 to -1.74 seen
	$\frac{8x-4-3x-9}{(x+3)(2x-1)}$	M1	
	$\frac{5x-13}{(x+3)(2x-1)}$ oe as final answer	A1	
	(b) Squares both sides of the equation $m = \frac{k^2 - 3n}{2l}$ as final answer	M1 A1	
(c) For num $\frac{p \pm \sqrt{q}}{r}$ $p = 4$ and $r = 6$ $q = 208$ or $\sqrt{q} = 14.4\dots$ $x = 3.07,$ $x = -1.74$ Final answers	B1 B1 B1 B1 [9]		
5	(a) (i) $p = 0.5, q = 0.2$ $r = 0.3$	B1 B1	Can be implied by $x + 2x + 54 = 78$
	(ii) (a) 0.25	B1	
	(b) (b) 0.5×0.2 seen 0.2	M1 A1	
	(b) (i) 17	B1	
(ii) $78 - 54$ soi $x = 8$	M1 A1 [8]		
6	(a) Either 136° or 44° correct Other one correct	B2 B1ft	After B0, allow SC1 for $\widehat{ACO} = 22^\circ, \widehat{ABC} = 68^\circ,$ $\widehat{AEC} = 68^\circ$ or for sum = 180° . Dep
	(b) $\widehat{ABC} = 68^\circ, \widehat{BAC} = 44^\circ$ and $\widehat{BCA} = 68^\circ$ Isosceles triangle	B1 B1 [5]	

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7	(a) Mid value used o.e. Sum of (value × frequency) / 80 3.45 (hours)	M1 M1 A1	
	(b) 73, 78	B1	
	(c) Correct scale, points correct and smooth curve	S1 P1 C1	Minus 1 each error P1 for 5 plots which could form ogive C1 reasonable curve
	(d) (i) 3.3 (hours)	B1ft	Read at 40 ft within 0.1
	(ii) Upper quartile and lower quartile used 2.5 (hours)	M1 A1ft[10]	Upper quartile – 2 ft within 0.1

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Section B

Qu	Answers	Mark	Comments
8	(a) $p = -2.6$ stated	B1	Lost for ruled lines, incomplete, very thick
	(b) Scales	S1	
	Five points plotted ft Smooth curve	P1ft C1	
	(c) $x = 2.55$ to 2.65	X1	
	(d) (i) $y = x$	L1	
	(ii) Line drawn and attempt to read at intersect $x = 2.4(0)$ to $2.5(0)$	M1 A1	
	(e) -4	G1	
	(f) (i) Correct line drawn	T1	
	(ii) $(0, 12)$	Y1ft	
	(iii) $y = -4x + 12$	E1ft [12]	
9	(a) (i) $\frac{90}{360} \times \pi \times 16$ $+16$ 28.56 to $28.6(0)$ cm	M1 M1 A1	Correct formula and 90° used Indep. Attempt to add $2 \times$ radius
	(ii) $\frac{90}{360} \times \pi \times 8^2$	M1	Area of cross-section
	[Their $\frac{90}{360} \times \pi \times 8^2$] $\times h$ $= 800$ soi	M1	Indep. Forms equation
	$h = 15.9(0)$ to 15.92 cm	A1	
	(b) (i) (a) $MN = 2x$	B1	Expect justification and a subtraction
	(b) Area of triangle = $\frac{1}{2}$ their $(2x \times x)$ Area of sector = 16π and Subtraction	M1 A1	
	(ii) $20(16\pi - x^2) = 800$	M1	
	$x^2 = 10.2\dots$ to 10.3	A1	
	$x = 3.2(0)$ to 3.21 cm	A1 [12]	

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10	(a) (i)	140°	B1	Correct method leading to solution		
	(ii)	$\frac{6 \times 180 - 4 \times 140}{4}$ or $3 \times 180 - 410$ or $180 - 50$ oe 130°	M1 A1			
	(b) (i)	$\tan 40^\circ = \frac{CT}{23}$ oe $CT = 19.29$ to $19.3(0)$ cm	M1 A1			
	(ii)	73×39.3 or 50×39.3 $\frac{1}{2} \times 23 \times (\text{their } CT)$ or $\frac{1}{2} (20 + 20 + \text{their } CT) \times 23$ 2640 to 2650 cm^2	M1 M1 A1			
	(iii)	10560 to 10600	B1ft			
	(iv) (a)	146 cm 79 cm	B1 B1ft			
	(b)	930 to 980 cm ² cao	B1 [12]			
	11	(a) (i)	$\begin{pmatrix} 6 \\ -5 \end{pmatrix}$		B1	Accept $-\frac{6}{5}$ but not 6, -5 or (6, -5)
		(ii)	Enlargement Scale factor $\frac{1}{2}$ Centre (4, 1)		M1 A1 A1	
		(iii)	Shear		B1	
(iv)		$y = x + c$ $y = x + 1$	M1 A1			
(b) (i)		x-coordinate $-q$ y-coordinate $-p$	B1 B1			
(ii)		x-coordinate q y-coordinate $-p$	B1 B1			
(iii)		$\mathbf{W} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$	B1 [12]			
				A1 and A1 not lost if transformation stated, when SC1 SC1 scored		
				Knowing the equation has gradient 1		
				SC1 for $\begin{pmatrix} -q \\ -p \end{pmatrix}$		
			SC1 for $\begin{pmatrix} q \\ -p \end{pmatrix}$			

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12	(a) (i) $p - q$	B1	Correct method
	(ii) $\frac{1}{2}(p - q) + \frac{1}{4}p$	M1	
	$\frac{3}{4}p - \frac{1}{2}q$ cao	A1	
	(b) (i) (a) $\frac{1}{2} \times 24 \times 17 \times \sin 55^\circ$	M1	
	167 to 167.5cm ²	A1	
	(b) Attempt at cosine rule	M1	
	$XY^2 = 865 - 816 \cos 55$	M1	
	19.9 to 19.93 (cm)	A2	
(ii) (a) $VZ^2 = 15^2 - 6^2$	M1	Value of 6 and correct use of Pythagoras	
$VZ = 13.7$ to 13.75 cm	A1		
(b) 766 cm ³ (Accept 762 – 766)	B1ft [12]	ft $\frac{1}{3} \times$ their (b)(i)(a) \times their (b)(ii)(a)	