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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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Section A

Qu	Answers	Mark	Comments
1	**(a)** f(7) = 1 as final answer	B1	
	(b) $\dfrac{t-2}{5} = t$	M1	Forms an equation in t and attempts to solve
	$t = -\dfrac{1}{2}$	A1	
	(c) Attempt to make x the subject $f^{-1}(x) = 5x + 2$	M1 A1 [5]	SC1 for $(x =)5y + 2$
2	**(a)** $\dfrac{66-48}{48}$ $(\times 100)$	M1	
	37.5%	A1	
	(b) 130% oe soi	M1	
	$\dfrac{19.5}{1.3}$ o.e	M1	
	($)15	A1	
	(c) (i) $88	B1	
	(ii) $79.20 $2.8(0) cao	B1√ft B1 [8]	Accept –2.8
3	**(a)** Rectangle 13 cm by 8 cm	B1	
	(b) (i) Constructs perpendicular bisector of ZY	B1	to cross rectangle
	Arc of circle radius 9 centre X	B1	across rectangle
	(ii) Labels the correct region	B1	No need to shade – but must be correct
	(c) (i) P and Q correctly positioned	B1ft	
	(ii) (a) 42 ±1 m cao	B1	Dep on correct P and Q
	(b) 107° (±2°) cao	B1 [7]	

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

7	(a)		Mid value used o.e.	M1	
			Sum of (value × frequency) / 80	M1	
			3.45 (hours)	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

Section B

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

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

12	(a)	(i)		$\mathbf{p} - \mathbf{q}$	B1	
		(ii)		$\dfrac{1}{2}(\mathbf{p} - \mathbf{q}) + \dfrac{1}{4}\mathbf{p}$	M1	Correct method
				$\dfrac{3}{4}\mathbf{p} - \dfrac{1}{2}\mathbf{q}$ cao	A1	
	(b)	(i)	(a)	$\dfrac{1}{2} \times 24 \times 17 \times \sin 55^\circ$	M1	
				167 to 167.5cm^2	A1	
			(b)	Attempt at cosine rule	M1	
				$XY^2 = 865 - 816 \cos 55$	M1	Correct formula and sign and correct algebra soi
				19.9 to 19.93 (cm)	A2	SC1 for 396 to 397 seen
		(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	B1ft	ft $\dfrac{1}{3} \times$ their **(b)(i)(a)** $\times$ their **(b)(ii)(a)**
				(Accept 762 – 766)	[12]	