UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

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

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International Examinations

Section A

Qu	Answers	Mark	Comments
1	**(a)** f(7) = 1 as final answer	B1	
	(b) $\frac{t-2}{5} = t$	M1	Forms an equation in t and attempts to solve
	$t = -\frac{1}{2}$	A1	
	(c) Attempt to make x the subject	M1	
	$f^{-1}(x) = 5x + 2$	A1 [5]	SC1 for $(x =)5y + 2$
2	**(a)** $\frac{66-48}{48}$ (× 100)	M1	
	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	B1√ft	
	$2.8(0) cao	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)**	$\frac{4(2x-1)-3(x+3)}{(x+3)(2x-1)}$	M1	Single fraction. Brackets not essential. Multiplies the first fraction by $(2x-1)$ and the second fraction by $(x+3)$
		$\frac{8x-4-3x-9}{(x+3)(2x-1)}$	M1	Multiplies out the numerator with at least 1 pair of terms correct
		$\frac{5x-13}{(x+3)(2x-1)}$ oe as final answer	A1	
	(b)	Squares both sides of the equation	M1	
		$m=\frac{k^2-3n}{2l}$ as final answer	A1	
	(c)	For num $\frac{p\pm\sqrt{q}}{r}$		
		$p = 4$ and $r = 6$	B1	s.o.i. or used
		$q = 208$ or $\sqrt{q} = 14.4...$	B1	
		$x = 3.07$, $x = -1.74$ Final answers	B1 B1 [9]	SC1 for both 3.0 to 3.1 and –1.7 to –1.74 seen
5	**(a)**	**(i)** $p = 0.5$, $q = 0.2$ $r = 0.3$	B1 B1	
		(ii) **(a)** 0.25	B1	
		(b) 0.5×0.2 seen 0.2	M1 A1	
	(b)	**(i)** 17	B1	
		(ii) $78 - 54$ soi $x = 8$	M1 A1 [8]	Can be implied by $x + 2x + 54 = 78$
6	**(a)**	Either 136° or 44° correct Other one correct	B2 B1ft	After B0, allow SC1 for $A\hat{C}O = 22°$, $A\hat{B}C = 68°$, $A\hat{E}C = 68°$ or for sum = 180°.
	(b)	$A\hat{B}C = 68°$, $B\hat{A}C = 44°$ and $B\hat{C}A = 68°$ Isosceles triangle	B1 B1 [5]	Dep

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

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)** $\frac{90}{360} \times \pi \times 16$	M1	Correct formula and 90° used
	+16	M1	Indep. Attempt to add 2 × radius
	28.56 to 28.6(0) cm	A1	
	(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	
	(b) Area of triangle = $\frac{1}{2}$ their $(2x \times x)$	M1	Expect justification and a subtraction
	Area of sector = 16π 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^o	B1	
	(ii)	$\frac{6\times180-4\times140}{4}$	M1	Correct method leading to solution
		or $3 \times 180 - 410$ or $180 - 50$ oe		
		130^o	A1	
	(b) **(i)**	$\tan 40^o = \frac{CT}{23}$ 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
		$\frac{1}{2}\times23\times(\text{their } CT)$ or $\frac{1}{2}(20+20+\text{their } CT)\times23$	M1	
		2640 to 2650 cm^2	A1	
	(iii)	10560 to 10600	B1ft	4 × their **(b)(ii)**
	(iv) **(a)**	146 cm 79 cm	B1 B1ft	40 + 2 × 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 $\begin{matrix}6\\-5\end{matrix}$ but not 6, –5 or (6, –5)
	(ii)	Enlargement	M1	
		Scale factor $\frac{1}{2}$	A1	A1 and A1 not lost if transformation stated, when SC1 SC1 scored
		Centre (4, 1)	A1	
	(iii)	Shear	B1	
	(iv)	$y = x$ (+ c) $y = x + 1$	M1 A1	Knowing the equation has gradient 1
	(b) **(i)**	x-coordinate $-q$ y-coordinate $-p$	B1 B1	SC1 for $\begin{pmatrix}-q\\-p\end{pmatrix}$
	(ii)	x-coordinate q y-coordinate $-p$	B1 B1	SC1 for $\begin{pmatrix}q\\-p\end{pmatrix}$
	(iii)	$\mathbf{W} = \begin{pmatrix}-1 & 0\\0 & 1\end{pmatrix}$	B1 [12]	

12	**(a) (i)** $\mathbf{p} - \mathbf{q}$	B1	
	(ii) $\frac{1}{2}(\mathbf{p} - \mathbf{q}) + \frac{1}{4}\mathbf{p}$	M1	Correct method
	$\frac{3}{4}\mathbf{p} - \frac{1}{2}\mathbf{q}$ cao	A1	
	(b) (i) (a) $\frac{1}{2} \times 24 \times 17 \times \sin 55^{o}$	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 (Accept 762 – 766)	B1ft [12]	ft $\frac{1}{3}$ × their **(b)(i)(a)** × their **(b)(ii)(a)**