Mark Scheme 4723 June 2007

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1 (i)	Attempt use of product rule	M1						
	Obtain $3x^2(x+1)^5 + 5x^3(x+1)^4$	A1	A1 2 or equiv					
	[Or: (following complete expansion and differentiati	-						
	Obtain $8x^7 + 35x^6 + 60x^5 + 50x^4 + 20x^3 + 3x^2$	B2		allow B1 if one term incorrect]				
(ii)	Obtain derivative of form $kx^3(3x^4 + 1)^n$	M1		any constants k and n				
	Obtain derivative of form $kx^3(3x^4 + 1)^{-\frac{1}{2}}$	M1						
	Obtain correct $6x^3(3x^4 + 1)^{-\frac{1}{2}}$	A1		3 or (unsimplified) equiv				
2	Identify critical value $x = 2$	B1						
	Attempt process for determining both	N/1						
	critical values	M1						
	Obtain $\frac{1}{3}$ and 2	A1						
	Attempt process for solving inequality	M1		table, sketch; implied by plausible answer				
	Obtain $\frac{1}{3} < x < 2$	A1	5	implied by plausible answer				
3 (i)	Attempt correct process for composition	M1		numerical or algebraic				
	Obtain (16 and hence) 7	A1	2					
(ii)	Attempt correct process for finding inverse	M1		maybe in terms of <i>y</i> so far				
	Obtain $(x-3)^2$	A1	2	or equiv; in terms of x , not y				
(iii)	Sketch (more or less) correct $y = f(x)$	B1		with 3 indicated or clearly implied on <i>y</i> -axis, correct curvature, no maximum point				
	Sketch (more or less) correct $y = f^{-1}(x)$ State reflection in line $y = x$	B1 B1	3	right hand half of parabola only or (explicit) equiv; independent of earlier marks				
4 (i)	Obtain integral of form $k(2x+1)^{\frac{4}{3}}$	M1		or equiv using substitution; any constant <i>k</i>				
	Obtain correct $\frac{3}{8}(2x+1)^{\frac{4}{3}}$	A1		or equiv				
	Substitute limits in expression of form $(2x+1)^n$							
	and subtract the correct way round	M 1		using adjusted limits if subn used				
	Obtain 30	A1	4					
(ii)	Attempt evaluation of $k(y_0 + 4y_1 + y_2)$	M1		any constant k				
	Identify k as $\frac{1}{3} \times 6.5$	A1						
	Obtain 29.6	A1	3	or greater accuracy (29.554566)				
	[SR: (using Simpson's rule with 4 strips)							
	Obtain $\frac{1}{3} \times 3.25(1 + 4 \times \sqrt[3]{7.5} + 2 \times \sqrt[3]{14} + 4 \times \sqrt[3]{20.5} + 3)$							
	and hence 29.9	B1		or greater accuracy (29.897)]				

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Attempt solution of equation of form $e^{-0.04t} = k$ M1using sound process; maybe impliedObtain 17A1 3or greater accuracy (17.328)(ii) Differentiate to obtain form $k e^{-0.04t}$ *M1constant k different from 240Obtain (\pm) 9.6 $e^{-0.04t}$ A1or (unsimplified) equivEquate attempt at first derivative to (\pm) 2.1 and attempt solutionM1dep *M; method maybe impliedObtain 38A14or greater accuracy (37.9956)5(i) Obtain integral of form $k_1e^{2x} + k_2x^2$ M1any non-zero constants k_1, k_2 Obtain $3e^{2a} + \frac{1}{2}a^2 - 3$ A1Equate definite integral to 42 and attempt rearrangementM1using sound processesConfirm $a = \frac{1}{2}\ln(15 - \frac{1}{6}a^2)$ A15AG; necessary detail required(ii) Obtain correct first iterate 1.348B1 Attempt correct process to find at least 2 iteratesM1 A1answer required to exactly 3 d.p.; allow recovery after error I $-1.34844 \rightarrow 1.34382 \rightarrow 1.34389$]							
impliedObtain 17A13or greater accuracy (17.328)(ii)Differentiate to obtain form $ke^{-0.0kt}$ *M1constant k different from 240Obtain (\pm) 9.6e ^{-0.0kt} A1or (unsimplified) equivEquate attempt a first derivative to (\pm) 2.1 and attempt solutionM1dep *M; method maybe impliedObtain 38A14or greater accuracy (37.9956)5(i)Obtain integral of form $ke^{2k} + k_2x^2$ M1any non-zero constants k_1, k_2 5(ii)Obtain correct $3e^{2k} + \frac{1}{2}x^2$ A1sound processesConfirm $a = \frac{1}{2} \ln(15 - \frac{1}{6}a^2)$ A15AG; necessary detail required(ii)Obtain correct first iterate 1.348 A trempt correct process to find at least 2 iteratesB1Obtain 1.34A14answer required to exactly 3 d.p.; allow recovery after error [1 \rightarrow 1.343844 \rightarrow 1.34382 \rightarrow 1.34389]7(i)Show correct general shape (alternating above and below x-axis) Draw (more or less) correct sketchM1with no branch reaching x-axis A1(iii)Attempt solution of cos $x = \frac{1}{3}$ Obtain 5.05 or 1.61 π M1maybe implied or greater accuracy and no others within $0 \le x \le 2\pi$; allow degrees at this stage(iii)Either:Obtain involve squaring, etc.) Attempt to obtain equi no of form $0, \theta + \pi$ M1within $0 \le x \le 2\pi$; allow degrees at this stage(Ditain 1.37 and 4.51 (or 0.437 π and 1.44 π)A14allow ± 1 in third sig fig; or greater accuracy(Dr(for methods	5 (i)	State e	-0.04t = 0.5	B1		or equiv	
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Obtain 1.37 and 4.51 (or equivs as above)A1ignoring values in second and four				M1			
			Obtain 1.37 and 4.51				
			(or equivs as above)	A1			

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8 (i)	Attempt use of quotient rule	M1		allow for numerator 'wrong way round'; or equiv
	Obtain $\frac{(4\ln x + 3)\frac{4}{x} - (4\ln x - 3)\frac{4}{x}}{(4\ln x + 3)^2}$	A1		or equiv
	Confirm $\frac{24}{x(4\ln x + 3)^2}$	A1	3	AG; necessary detail required
(ii)	Identify $\ln x = \frac{3}{4}$	B1		or equiv
	State or imply $x = e^{\frac{3}{4}}$	B1		
	Substitute e^k completely in expression for			
	derivative	M 1		and deal with $\ln e^k$ term
	Obtain $\frac{2}{3}e^{-\frac{3}{4}}$	A1	4	or exact (single term) equiv
(iii)	State or imply $\int \frac{4\pi}{x(4\ln x + 3)^2} dx$	B1		
	Obtain integral of form $k \frac{4 \ln x - 3}{4 \ln x + 3}$			
	or $k(4\ln x + 3)^{-1}$	*M1		any constant k
	Substitute both limits and subtract right way			
	round	M1		dep *M
	Obtain $\frac{4}{21}\pi$	A1	4	or exact equiv
9 (i)	Attempt use of either of $tan(A \pm B)$ identities	M1		
) (I)	Substitute $\tan 60^\circ = \sqrt{3}$ or $\tan^2 60^\circ = 3$	B1		
	Obtain $\frac{\tan \theta + \sqrt{3}}{1 - \sqrt{3} \tan \theta} \times \frac{\tan \theta - \sqrt{3}}{1 + \sqrt{3} \tan \theta}$	A1		or equiv (perhaps with tan 60 $^{\circ}$
	$1 - \sqrt{3} \tan \theta$ $1 + \sqrt{3} \tan \theta$			still involved)
	Obtain $\frac{\tan^2 \theta - 3}{1 - 3 \tan^2 \theta}$			still involved)
	Obtain $\frac{\tan^2 \theta}{1 - 3\tan^2 \theta}$	A1	4	AG
(ii)	Use $\sec^2 \theta = 1 + \tan^2 \theta$	B1		
	Attempt rearrangement and simplification of			
	equation involving $\tan^2 \theta$	M1		or equiv involving $\sec \theta$
	Obtain $\tan^4 \theta = \frac{1}{3}$	A1		or equiv $\sec^2 \theta = 1.57735$
	Obtain 37.2 Obtain 142.8	A1 A1	5	or greater accuracy or greater accuracy; and no others between 0 and 180
(iii)	Attempt rearrangement of $\frac{\tan^2 \theta - 3}{1 - 3 \tan^2 \theta} = k^2$ to form			
	$\mathcal{C}(1)$			

ii) Attempt rearrangement of
$$\frac{\tan \theta}{1 - 3\tan^2 \theta} = k^2$$
 to form
 $\tan^2 \theta = \frac{f(k)}{g(k)}$ M1

Obtain
$$\tan^2 \theta = \frac{k^2 + 3}{1 + 3k^2}$$
 A1

Observe that RHS is positive for all *k*, giving one value in each quadrant

A1 3 or convincing equiv