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Mark Scheme (Results)

January 2008

GCE

GCE Mathematics (6665/01)

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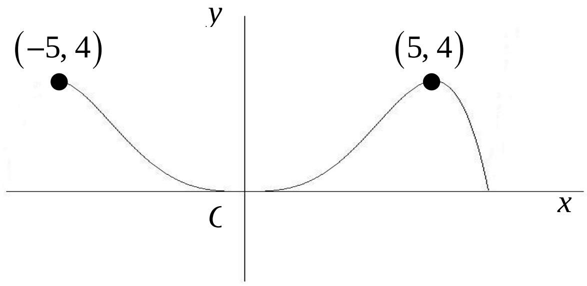
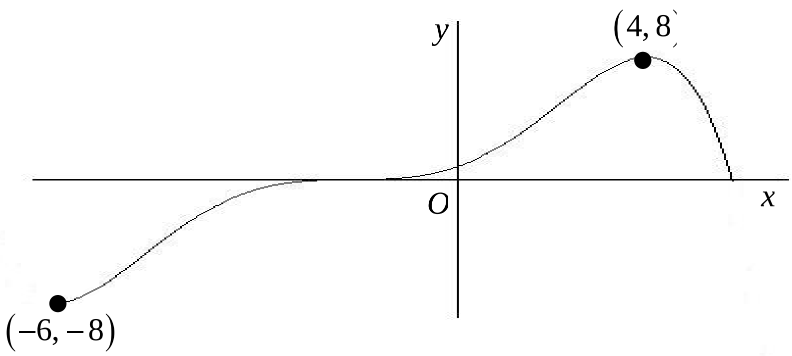
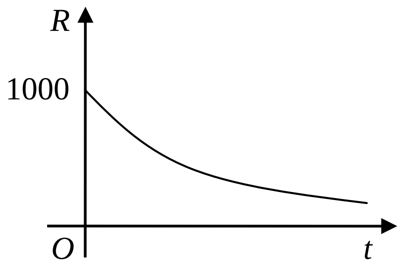
January 2008
6665 Core Mathematics C3
Mark Scheme

Question Number	Scheme	Marks
1.	$$\begin{array}{r|l} & 2x^2 \quad -1 \\ \hline x^2-1 & 2x^4 \quad -3x^2+x+1 \\ & 2x^4 \quad -2x^2 \\ \hline & \quad -x^2+x+1 \\ & \quad -x^2 \quad +1 \\ \hline & \qquad x \end{array}$$	M1
	$a=2$ stated or implied	A1
	$c=-1$ stated or implied	A1
	$2x^2-1+\dfrac{x}{x^2-1}$	
	$a=2, b=0, c=-1, d=1, e=0$	
	$d=1$ and $b=0, e=0$ stated or implied	A1 **[4]**
2.	(a) $\dfrac{dy}{dx}=2e^{2x}\tan x+e^{2x}\sec^2 x$	M1 A1+A1
	$\dfrac{dy}{dx}=0 \Rightarrow 2e^{2x}\tan x+e^{2x}\sec^2 x=0$	M1
	$2\tan x+1+\tan^2 x=0$	A1
	$(\tan x+1)^2=0$	
	$\tan x=-1$ ∗ cso	A1 (6)
	(b) $\left(\dfrac{dy}{dx}\right)_0=1$	M1
	Equation of tangent at $(0,0)$ is $y=x$	A1 (2) **[8]**

Question Number	Scheme		Marks	
3.	(a) $\mathrm{f}(2) = 0.38\ \dots$			
	$\mathrm{f}(3) = -0.39\ \dots$		M1	
	Change of sign (and continuity) $\Rightarrow$ root in $(2, 3)$ ∗	cso	A1	(2)
	(b) $x_1 = \ln 4.5 + 1 \approx 2.50408$		M1	
	$x_2 \approx 2.50498$		A1	
	$x_3 \approx 2.50518$		A1	(3)
	(c) Selecting $[2.5045, 2.5055]$, or appropriate tighter range, and evaluating at both ends.		M1	
	$\mathrm{f}(2.5045) \approx 6 \times 10^{-4}$			
	$\mathrm{f}(2.5055) \approx -2 \times 10^{-4}$			
	Change of sign (and continuity) $\Rightarrow$ root $\in (2.5045, 2.5055)$			
	$\Rightarrow$ root $= 2.505$ to 3 dp ∗	cso	A1	(2)
				[7]
	Note: The root, correct to 5 dp, is 2.50524			

Question Number	Scheme	Marks	
4.	(a)		
			
	Shape	B1	
	$(5, 4)$	B1	
	$(-5, 4)$	B1	(3)
	(b) For the purpose of marking this paper, the graph is identical to (a)		
	Shape	B1	
	$(5, 4)$	B1	
	$(-5, 4)$	B1	(3)
	(c)		
			
	General shape – unchanged	B1	
	Translation to left	B1	
	$(4, 8)$	B1	
	$(-6, -8)$	B1	(4)
	In all parts of this question ignore any drawing outside the domains shown in the diagrams above.		**[10]**

Question Number	Scheme		Marks	
5.	(a) 1000		B1	(1)
	(b) $1000\,\mathrm{e}^{-5730c} = 500$		M1	
	$\mathrm{e}^{-5730c} = \frac{1}{2}$		A1	
	$-5730c = \ln\frac{1}{2}$		M1	
	$c = 0.000121$	cao	A1	(4)
	(c) $R = 1000\,\mathrm{e}^{-22920c} = 62.5$	Accept 62-63	M1 A1	(2)
	(d) 	Shape 1000	B1 B1	(2) **[9]**

Question Number	Scheme	Marks
6.	(a) $\cos(2x+x) = \cos 2x\cos x - \sin 2x \sin x$	M1
	$= \left(2\cos^2 x - 1\right)\cos x - \left(2\sin x\cos x\right)\sin x$	M1
	$= \left(2\cos^2 x - 1\right)\cos x - 2(1-\cos^2 x)\cos x$ any correct expression	A1
	$= 4\cos^3 x - 3\cos x$	A1 (4)
	(b)(i) $\dfrac{\cos x}{1+\sin x} + \dfrac{1+\sin x}{\cos x} = \dfrac{\cos^2 x + (1+\sin x)^2}{(1+\sin x)\cos x}$	M1
	$= \dfrac{\cos^2 x + 1 + 2\sin x + \sin^2 x}{(1+\sin x)\cos x}$	A1
	$= \dfrac{2(1+\sin x)}{(1+\sin x)\cos x}$	M1
	$= \dfrac{2}{\cos x} = 2\sec x$ * cso	A1 (4)
	(c) $\sec x = 2$ *or* $\cos x = \dfrac{1}{2}$	M1
	$x = \dfrac{\pi}{3}, \dfrac{5\pi}{3}$ accept awrt 1.05, 5.24	A1, A1 (3)
		[11]
7.	(a) $\dfrac{dy}{dx} = 6\cos 2x - 8\sin 2x$	M1 A1
	$\left(\dfrac{dy}{dx}\right)_0 = 6$	B1
	$y - 4 = -\dfrac{1}{6}x$ or equivalent	M1 A1 (5)
	(b) $R = \sqrt{\left(3^2 + 4^2\right)} = 5$	M1 A1
	$\tan\alpha = \dfrac{4}{3}$, $\alpha \approx 0.927$ awrt 0.927	M1 A1 (4)
	(c) $\sin\left(2x + \text{ their } \alpha\right) = 0$	M1
	$x = -2.03, -0.46, 1.11, 2.68$	A1 A1 A1 (4)
	First A1 any correct solution; second A1 a second correct solution; third A1 all four correct and to the specified accuracy or better. Ignore the y-coordinate.	**[13]**

Question Number	Scheme		Marks	
8.	(a) $x = 1 - 2y^3 \Rightarrow y = \left(\frac{1-x}{2}\right)^{1/3}$ *or* $\sqrt[3]{\frac{1-x}{2}}$		M1 A1	(2)
	$\mathrm{f}^{-1} : x \mapsto \left(\frac{1-x}{2}\right)^{1/3}$	Ignore domain		
	(b) $\mathrm{gf}(x) = \frac{3}{1-2x^3} - 4$		M1 A1	
	$= \frac{3 - 4(1-2x^3)}{1-2x^3}$		M1	
	$= \frac{8x^3 - 1}{1-2x^3}$ $\ast$	cso	A1	(4)
	$\mathrm{gf} : x \mapsto \frac{8x^3-1}{1-2x^3}$	Ignore domain		
	(c) $8x^3 - 1 = 0$	Attempting solution of numerator = 0	M1	
	$x = \frac{1}{2}$	Correct answer and no additional answers	A1	(2)
	(d) $\frac{dy}{dx} = \frac{(1-2x^3)\times 24x^2 + (8x^3-1)\times 6x^2}{(1-2x^3)^2}$		M1 A1	
	$= \frac{18x^2}{(1-2x^3)^2}$		A1	
	Solving their numerator = 0 and substituting to find y.		M1	
	$x = 0,\ y = -1$		A1	(5) **[13]**