Edexcel GCE
Core Mathematics C3

Gold Level G4

(Mark Scheme)

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6665 Core Mathematics C3 – G1 Mark Scheme

Question Number	Scheme	Marks
1. (*a*)	$\ln 3x = \ln 6$ or $\ln x = \ln\left(\frac{6}{3}\right)$ or $\ln\left(\frac{3x}{6}\right) = 0$	M1
	$x = 2$ (only this answer)	A1 (cso) (2)
(*b*)	$(e^x)^2 - 4e^x + 3 = 0$ (any 3 term form)	M1
	$(e^x - 3)(e^x - 1) = 0$	
	$e^x = 3$ or $e^x = 1$ Solving quadratic	M1 dep
	$x = \ln 3$, $x = 0$ (or ln 1)	M1 A1 (4)
		(6 marks)
2.	(a)	
	$$\frac{dy}{dx} = 2e^{2x}\tan x + e^{2x}\sec^2 x$$	M1 A1+A1
	$\frac{dy}{dx} = 0 \Rightarrow 2e^{2x}\tan x + e^{2x}\sec^2 x = 0$	M1
	$2\tan x + 1 + \tan^2 x = 0$	A1
	$(\tan x + 1)^2 = 0$	
	$\tan x = -1$ ∗ cso	A1 (6)
	(b) $\left(\frac{dy}{dx}\right)_0 = 1$	M1
	Equation of tangent at $(0, 0)$ is $y = x$	A1 (2)
		[8]

Question Number	Scheme	Marks
3(a)	$2\cos x\cos 50 - 2\sin x\sin 50 = \sin x\cos 40 + \cos x\sin 40$	M1
	$\sin x(\cos 40 + 2\sin 50) = \cos x(2\cos 50 - \sin 40)$	
	$\div\cos x \Rightarrow \tan x(\cos 40 + 2\sin 50) = 2\cos 50 - \sin 40$	M1
	$\tan x = \dfrac{2\cos 50 - \sin 40}{\cos 40 + 2\sin 50}$, (or numerical answer awrt 0.28)	A1
	States or uses cos50 = sin40 and cos40 =sin50 and so $\tan x^{\circ} = \frac{1}{3}\tan 40^{\circ}$ *	A1 cao **(4)**
(b)	Deduces $\tan 2\theta = \frac{1}{3}\tan 40$	M1
	$2\theta =$ 15.6 so $\theta =$ awrt 7.8(1) One answer	A1
	Also $2\theta =$ 195.6, 375.6 , 555.6 $\Rightarrow \theta = ..$	M1 A1
	$\theta =$ awrt 7.8 , 97.8, 187.8, 277.8 All 4 answers	
		(4)
		[8]
4.	$x = \cos(2y+\pi)$	
	$\dfrac{dx}{dy} = -2\sin(2y+\pi)$	M1 A1
	$\dfrac{dy}{dx} = -\dfrac{1}{2\sin(2y+\pi)}$ Follow through their $\dfrac{dx}{dy}$ before or after substitution	A1ft
	At $y = \dfrac{\pi}{4}$, $\dfrac{dy}{dx} = -\dfrac{1}{2\sin\frac{3\pi}{2}} = \dfrac{1}{2}$	B1
	$y - \dfrac{\pi}{4} = \dfrac{1}{2}x$	M1
	$y = \dfrac{1}{2}x + \dfrac{\pi}{4}$	A1 (6)
		[6]

Question Number	Scheme	Marks
5(a)	$\frac{dx}{dy} = 2\times 3\sec 3y\sec 3y\tan 3y = \left(6\sec^2 3y\tan 3y\right)$ $\left(\text{oe } \frac{6\sin 3y}{\cos^3 3y}\right)$	M1 A1 **(2)**
(b)	Uses $\frac{dy}{dx} = \frac{1}{\frac{dx}{dy}}$ to obtain $\frac{dy}{dx} = \frac{1}{6\sec^2 3y\tan 3y}$	M1
	$\tan^2 3y = \sec^2 3y - 1 = x - 1$	B1
	Uses $\sec^2 3y = x$ and $\tan^2 3y = \sec^2 3y - 1 = x - 1$ to get $\frac{dy}{dx}$ or $\frac{dx}{dy}$ in just x.	M1
	$\Rightarrow \frac{dy}{dx} = \frac{1}{6x(x-1)^{\frac{1}{2}}}$	A1* **(4)**
(c)	$\frac{d^2y}{dx^2} = \frac{0-[6(x-1)^{\frac{1}{2}} + 3x(x-1)^{-\frac{1}{2}}]}{36x^2(x-1)}$	M1 A1
	$\frac{d^2y}{dx^2} = \frac{6-9x}{36x^2(x-1)^{\frac{3}{2}}} = \frac{2-3x}{12x^2(x-1)^{\frac{3}{2}}}$	M1 A1 **(4)**
		[10]
6 (a)(i)	$\sin 3\theta = \sin\left(2\theta + \theta\right)$	
	$= \sin 2\theta\cos\theta + \cos 2\theta\sin\theta$	
	$= 2\sin\theta\cos\theta.\cos\theta + \left(1-2\sin^2\theta\right)\sin\theta$	M1 A1
	$= 2\sin\theta\left(1-\sin^2\theta\right) + \sin\theta - 2\sin^3\theta$	M1
	$= 3\sin\theta - 4\sin^3\theta$ * cso	A1 (4)
(ii)	$8\sin^3\theta - 6\sin\theta + 1 = 0$	
	$-2\sin 3\theta + 1 = 0$	M1 A1
	$\sin 3\theta = \frac{1}{2}$	M1
	$3\theta = \frac{\pi}{6}, \frac{5\pi}{6}$	
	$\theta = \frac{\pi}{18}, \frac{5\pi}{18}$	A1 A1 (5)

Question Number	Scheme	Marks
(b)	$\sin 15° = \sin(60° - 45°) = \sin 60° \cos 45° - \cos 60° \sin 45°$	M1
	$= \frac{\surd 3}{2} \times \frac{1}{\surd 2} - \frac{1}{2} \times \frac{1}{\surd 2}$	M1 A1
	$= \frac{1}{4}\surd 6 - \frac{1}{4}\surd 2 = \frac{1}{4}(\surd 6 - \surd 2)$ * cso	A1 (4)
		[13]

Question Number	Scheme	Marks
7. (a)	$R = \sqrt{6.25}$ or 2.5	B1
	$\tan\alpha = \frac{1.5}{2} = \frac{3}{4} \Rightarrow \alpha = \text{awrt } 0.6435$	M1A1
		(3)
(b) (i)	Max Value $= 2.5$	B1 $\sqrt{}$
(ii)	$\underline{\sin(\theta - 0.6435) = 1}$ or $\underline{\theta - \text{their }\alpha = \frac{\pi}{2}}$; $\Rightarrow \theta = \text{awrt } 2.21$	M1;A1 $\sqrt{}$
		(3)
(c)	$H_{\text{Max}} = 8.5$ (m)	B1 $\sqrt{}$
	$\underline{\sin\left(\frac{4\pi t}{25} - 0.6435\right) = 1}$ or $\underline{\frac{4\pi t}{25} = \text{their (b) answer}}$; $\Rightarrow t = \text{awrt } 4.41$	M1;A1
		(3)
(d)	$\Rightarrow 6 + 2.5\sin\left(\frac{4\pi t}{25} - 0.6435\right) = 7$; $\Rightarrow \sin\left(\frac{4\pi t}{25} - 0.6435\right) = \frac{1}{2.5} = 0.4$	M1;M1
	$\left\{\frac{4\pi t}{25} - 0.6435\right\} = \sin^{-1}(0.4)$ or awrt 0.41	A1
	Either $t = \text{awrt } 2.1$ or awrt 6.7	A1
	So, $\left\{\frac{4\pi t}{25} - 0.6435\right\} = \left\{\pi - 0.411517\ldots \text{ or } 2.730076\ldots^{c}\right\}$	ddM1
	Times $= \{14:06,\ 18:43\}$	A1
		(6)
		[15]

Question Number	Scheme		Marks
8. (a)	$y = \sec x = \dfrac{1}{\cos x} = (\cos x)^{-1}$		
	$\dfrac{dy}{dx} = -1(\cos x)^{-2}(-\sin x)$	Writes $\sec x$ as $(\cos x)^{-1}$ and gives $\dfrac{dy}{dx} = \pm\left((\cos x)^{-2}(\sin x)\right)$	M1
		$-1(\cos x)^{-2}(-\sin x)$ or $(\cos x)^{-2}(\sin x)$	A1
	$\dfrac{dy}{dx} = \left\{\dfrac{\sin x}{\cos^2 x}\right\} = \underline{\underline{\left(\dfrac{1}{\cos x}\right)\left(\dfrac{\sin x}{\cos x}\right)}} = \underline{\underline{\sec x \tan x}}$	Convincing proof. Must see both underlined steps.	A1 (3)
(b)	$x = \sec 2y, \quad y \neq (2n+1)\frac{\pi}{4}, n \in \mathbb{Z}$.		
	$\dfrac{dx}{dy} = 2\sec 2y \tan 2y$	$K \sec 2y \tan 2y$	M1
		$2\sec 2y \tan 2y$	A1 (2)
(c)	$\dfrac{dy}{dx} = \dfrac{1}{2\sec 2y \tan 2y}$	Applies $\dfrac{dy}{dx} = \dfrac{1}{\left(\frac{dx}{dy}\right)}$	M1
	$\dfrac{dy}{dx} = \dfrac{1}{2x \tan 2y}$	Substitutes x for $\sec 2y$.	M1
	$1 + \tan^2 A = \sec^2 A \Rightarrow \tan^2 2y = \sec^2 2y - 1$	Attempts to use the identity $1 + \tan^2 A = \sec^2 A$	M1
	So $\tan^2 2y = x^2 - 1$		
	$\dfrac{dy}{dx} = \dfrac{1}{2x\sqrt{(x^2-1)}}$	$\dfrac{dy}{dx} = \dfrac{1}{2x\sqrt{(x^2-1)}}$	A1
			(4)
			[9]

Statistics for C3 Practice Paper G4

Qu	Max score	Modal score	Mean %	ALL	A*	A	B	C	D	E	U
				Mean score for students achieving grade:							
1	6	n/a	47	2.80		4.02	2.54	1.96	1.55	1.21	0.80
2	8	n/a	61	4.87		7.30	6.15	4.83	3.44	2.45	0.98
3	8	1	45	3.59	6.41	4.72	3.62	2.69	1.99	1.32	0.63
4	6		51	3.07		5.19	4.04	2.96	1.89	1.35	0.31
5	10	6	40	4.04	7.64	6.01	4.29	2.75	1.56	0.79	0.34
6	13		58	7.56		11.92	9.15	6.96	4.86	2.38	1.29
7	15		53	8.00	13.85	11.29	8.26	5.43	3.49	2.08	0.94
8	9		48	4.34	8.36	6.57	4.79	3.36	2.43	1.30	0.62
	75		**51**	**38.27**		**57.02**	**42.84**	**30.94**	**21.21**	**12.88**	**5.91**