Edexcel GCE
Core Mathematics C3
Gold Level G2
(Mark Scheme)

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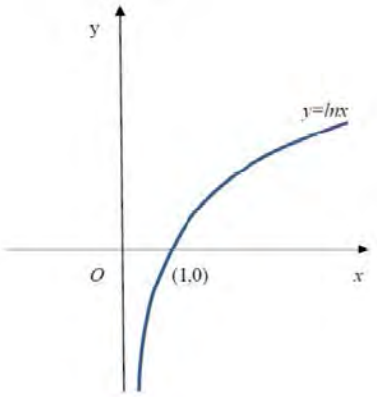
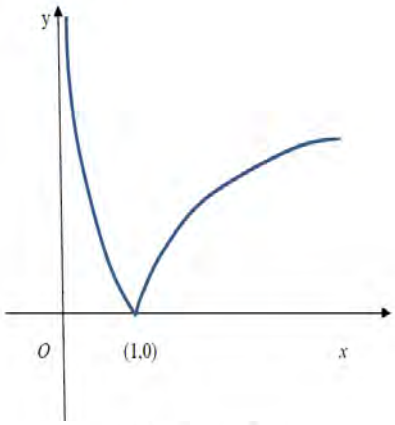
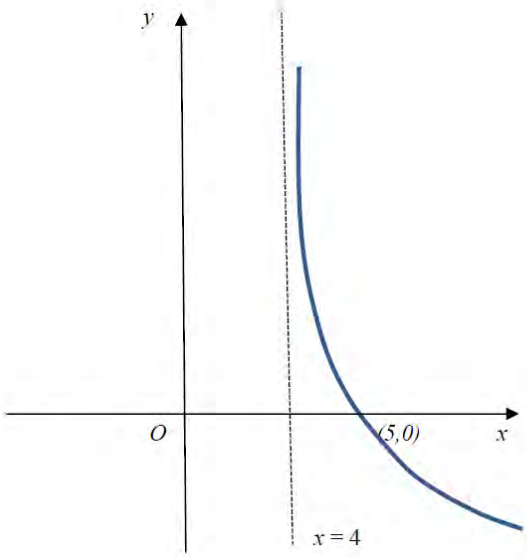
Question Number	Scheme	Marks
1 **By Division**	$$\begin{array}{r} 3x^2-2x+7 \\ x^2(+0x)-4\overline{)3x^4-2x^3-5x^2+(0x)-4} \\ \underline{3x^4+0x^3-12x^2} \\ -2x^3+7x^2+0x \\ \underline{-2x^3+0x^2+8x} \\ 7x^2-8x-4 \\ \underline{7x^2+0x-28} \\ -8x+24 \end{array}$$	
	$a=3$	**B1**
	$$\begin{array}{r} 3x^2-2x..... \\ x^2(+0x)-4\overline{)3x^4-2x^3-5x^2+(0x)-4} \\ \underline{3x^4+0x^3-12x^2} \\ -2x^3+..... \\ \underline{-2x^3+.....} \end{array}$$ Long division as far as	**M1**
	Two of $b=-2 \quad c=7 \quad d=-8 \quad e=24$	**A1**
	All four of $b=-2 \quad c=7 \quad d=-8 \quad e=24$	**A1**
		[4]

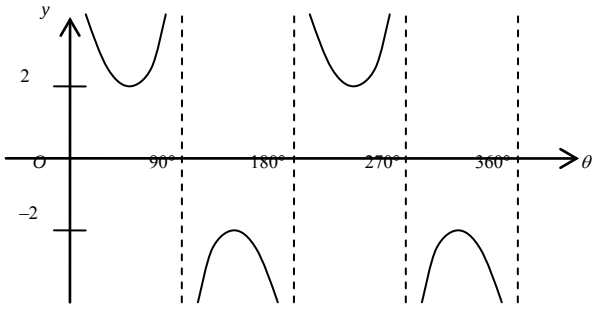
Question Number	Scheme	Marks
2(i)	 *ln* graph crossing *x* axis at (1,0) and asymptote at *x*=0	B1
2(ii)	 Shape including cusp Touches or crosses the *x* axis at (1,0) Asymptote given as *x*=0	B1ft B1ft B1
2(iii)	 Shape Crosses at (5, 0) Asymptote given as *x*=4	B1 B1ft B1 **[7]**

Question Number	Scheme	Marks
3. (a)	$\frac{dy}{dx} = \sqrt{3}e^{x\sqrt{3}} \sin 3x + 3e^{x\sqrt{3}} \cos 3x$	M1A1
	$\frac{dy}{dx} = 0 \qquad e^{x\sqrt{3}}(\sqrt{3}\sin 3x + 3\cos 3x) = 0$	M1
	$\tan 3x = -\sqrt{3}$	A1
	$3x = \frac{2\pi}{3} \Rightarrow x = \frac{2\pi}{9}$	M1A1
		(6)
(b)	At $x = 0 \qquad \frac{dy}{dx} = 3$	B1
	Equation of normal is $-\frac{1}{3} = \frac{y-0}{x-0}$ or any equivalent $y = -\frac{1}{3}x$	M1A1
		(3) **(9 marks)**

Question Number	Scheme	Marks
4.	$\left(\frac{dx}{dy}\right) = 2sec^2\left(y + \frac{\pi}{12}\right)$	M1, A1
	substitute $y = \frac{\pi}{4}$ into their $\frac{dx}{dy} = 2sec^2\left(\frac{\pi}{4} + \frac{\pi}{12}\right) = 8$	M1, A1
	When $y = \frac{\pi}{4}$. $x = 2\sqrt{3}$ awrt 3.46	B1
	$\left(y - \frac{\pi}{4}\right) = their\ m(x - their\ 2\sqrt{3})$	M1
	$\left(y - \frac{\pi}{4}\right) = -8\left(x - 2\sqrt{3}\right)$ oe	A1
		(7 marks)

Question Number	Scheme		Marks
5. **(a)**	$\theta = 20 + A\mathrm{e}^{-kt}$ (eqn *)		
	$\{t = 0, \theta = 90 \Rightarrow\}$ $90 = 20 + A\mathrm{e}^{-k(0)}$	Substitutes $t = 0$ and $\theta = 90$ into eqn *	M1
	$90 = 20 + A \Rightarrow \underline{A = 70}$	$\underline{A = 70}$	A1 (2)
(b)	$\theta = 20 + 70\mathrm{e}^{-kt}$		
	$\{t = 5, \theta = 55 \Rightarrow\}$ $55 = 20 + 70\mathrm{e}^{-k(5)}$	Substitutes $t = 5$ and $\theta = 55$ into eqn * and rearranges eqn * to make $\mathrm{e}^{\pm 5k}$ the subject.	M1
	$\frac{35}{70} = \mathrm{e}^{-5k}$		
	$\ln\left(\frac{35}{70}\right) = -5k$	Takes 'lns' and proceeds to make '$\pm 5k$' the subject.	dM1
	$-5k = \ln\left(\frac{1}{2}\right)$		
	$-5k = \ln 1 - \ln 2 \Rightarrow -5k = -\ln 2 \Rightarrow \underline{k = \frac{1}{5}\ln 2}$	Convincing proof that $k = \frac{1}{5}\ln 2$	A1 * (3)
(c)	$\theta = 20 + 70\mathrm{e}^{-\frac{1}{5}t\ln 2}$		
	$\frac{\mathrm{d}\theta}{\mathrm{d}t} = -\frac{1}{5}\ln 2.(70)\mathrm{e}^{-\frac{1}{5}t\ln 2}$	$\pm\alpha\,\mathrm{e}^{-kt}$ where $k = \frac{1}{5}\ln 2$ $-14\ln 2\,\mathrm{e}^{-\frac{1}{5}t\ln 2}$	M1 A1 oe
	When $t = 10$, $\frac{\mathrm{d}\theta}{\mathrm{d}t} = -14\ln 2\,\mathrm{e}^{-2\ln 2}$		
	$\frac{\mathrm{d}\theta}{\mathrm{d}t} = -\frac{7}{2}\ln 2 = -2.426015132...$		
	Rate of decrease of $\theta = 2.426\ ^{\circ}C/\min$ (3 dp.)	awrt ± 2.426	A1 (3) **[8]**

Question Number	Scheme	Marks
6(a)	$\ln(4-2x)(9-3x), = \ln(x+1)^2$	M1, M1
	So $36-30x+6x^2 = x^2+2x+1$ and $5x^2-32x+35=0$	A1
	Solve $5x^2-32x+35=0$ to give $x=\frac{7}{5}$ oe (Ignore the solution $x=5$)	M1 A1 (5)
(b)	Take $\log_e$'s to give $\ln 2^x + \ln e^{3x+1} = \ln 10$	M1
	$x\ln 2 + (3x+1)\ln e = \ln 10$	M1
	$x(\ln 2 + 3\ln e) = \ln 10 - \ln e \Rightarrow x = ..$	dM1
	and uses $\ln e = 1$	M1
	$x = \frac{-1+\ln 10}{3+\ln 2}$	A1 (5)
		[10]

Question Number	*Scheme*		Marks
7. (*a*)	$\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta} = \frac{\sin^2\theta+\cos^2\theta}{\cos\theta\sin\theta}$		M1
	M1 Use of common denominator to obtain single fraction		
	$= \frac{1}{\cos\theta\sin\theta}$		M1
	M1 Use of appropriate trig identity (in this case $\sin^2\theta+\cos^2\theta=1$)		
	$= \frac{1}{\frac{1}{2}\sin 2\theta}$ Use of $\sin 2\theta = 2\sin\theta\cos\theta$		M1
	$= 2\text{cosec}2\theta$ (✱)		A1 cso (4)
(*b*)		Shape (May be translated but need to see 4"sections")	B1
		T.P.s at $y = \pm 2$, asymptotic at correct x-values (dotted lines not required)	B1 dep. (2)
(*c*)	$2\text{cosec}2\theta = 3$		
	$\sin 2\theta = \frac{2}{3}$ Allow $\frac{2}{\sin 2\theta} = 3$ [M1 for equation in $\sin 2\theta$]		M1, A1
	(2θ) = [41.810…°, 138.189…° ; 401.810…°, 498.189…°]		M1; M1
	1st M1 for $\alpha, 180-\alpha$; 2nd M1 adding 360° to at least one of values		
	$\theta = 20.9°, 69.1°, 200.9°, 249.1°$ (1 d.p.) awrt		A1,A1 (6)

Question Number	Scheme	Marks
Q8	$\text{cosec}^2 2x - \cot 2x = 1, \quad (\text{eqn } *) \qquad 0 \le x \le 180^\circ$	
	Using $\text{cosec}^2 2x = 1 + \cot^2 2x$ gives $1 + \cot^2 2x - \cot 2x = 1$	M1
	$\underline{\cot^2 2x - \cot 2x = 0}$ or $\cot^2 2x = \cot 2x$	A1
	$\cot 2x(\cot 2x - 1) = 0$ or $\cot 2x = 1$	dM1
	$\cot 2x = 0$ or $\cot 2x = 1$	A1
	$\cot 2x = 0 \Rightarrow (\tan 2x \to \infty) \Rightarrow 2x = 90, 270$	
	$\Rightarrow x = 45, 135$	M1
	$\cot 2x = 1 \Rightarrow \tan 2x = 1 \Rightarrow 2x = 45, 225$	
	$\Rightarrow x = 22.5, 112.5$	
	Overall, $x = \{22.5, 45, 112.5, 135\}$	A1 B1
		[7]

Question Number	Scheme	Marks
9(a)	$0 \leqslant f(x) \leqslant 10$	B1 (1)
(b)	$ff(0) = f(5), = 3$	B1, B1 (2)
(c)	$y = \dfrac{4+3x}{5-x} \Rightarrow y(5-x) = 4+3x$	
	$\Rightarrow 5y - 4 = xy + 3x$	M1
	$\Rightarrow 5y - 4 = x(y+3) \Rightarrow x = \dfrac{5y-4}{y+3}$	dM1
	$g^{-1}(x) = \dfrac{5x-4}{3+x}$	A1 (3)
(d)	$gf(x) = 16 \Rightarrow f(x) = g^{-1}(16) = 4$ oe	M1 A1
	$f(x) = 4 \Rightarrow x = 6$	B1
	$f(x) = 4 \Rightarrow 5 - 2.5x = 4 \Rightarrow x = 0.4$ oe	M1 A1 (5)
		[11]

Statistics for C3 Practice Paper G2

				Mean score for students achieving grade:							
Qu	**Max score**	**Modal score**	**Mean %**	**ALL**	**A***	**A**	**B**	**C**	**D**	**E**	**U**
1	4	4	68	2.71	3.64	3.19	2.81	2.48	2.12	1.81	1.31
2	7	7	68	4.77	6.50	5.83	5.08	4.34	3.56	2.77	1.69
3	9		62	5.56	8.61	7.40	5.94	4.41	2.88	1.60	0.57
4	7		58	4.04	6.80	5.90	4.80	3.63	2.54	1.69	0.45
5	8		59	4.68	7.37	6.26	5.19	4.42	3.62	2.74	1.92
6	10	10	55	5.49	9.39	7.46	5.66	4.23	3.08	2.10	1.07
7	12		69	8.24		10.40	8.65	7.42	5.93	4.39	2.51
8	7		43	3.00		5.23	3.39	2.37	1.46	0.73	0.37
9	11	4	45	4.99	8.50	6.41	4.95	3.90	3.02	2.11	1.19
	75		**58**	**43.48**		**58.08**	**46.47**	**37.20**	**28.21**	**19.94**	**11.08**