Edexcel GCE
Core Mathematics C4
Gold Level G2
(Mark Scheme)

Mr.S.V.Swarnaraja (Marking Examiner, Team Leader & Author)
www.swanash.com, Mobile: +94777304755 , email: swa@swanash.com

Question Number	Scheme	Marks
1. (a)	$1 = A(3x-1)^2 + Bx(3x-1) + Cx$	B1
	$x \to 0 \qquad (1 = A)$	M1
	$x \to \frac{1}{3} \qquad 1 = \frac{1}{3}C \Rightarrow C = 3$ any two constants correct	A1
	Coefficients of x^2 $0 = 9A + 3B \Rightarrow B = -3$ all three constants correct	A1 **(4)**
(b)	(i) $\int\left(\frac{1}{x} - \frac{3}{3x-1} + \frac{3}{(3x-1)^2}\right)\mathrm{d}x$	
	$= \ln x - \frac{3}{3}\ln(3x-1) + \frac{3}{(-1)3}(3x-1)^{-1} \quad (+C)$	M1 A1ft A1ft
	$\left(= \ln x - \ln(3x-1) - \frac{1}{3x-1} \quad (+C)\right)$	
	(ii) $\int_1^2 \mathrm{f}(x)\mathrm{d}x = \left[\ln x - \ln(3x-1) - \frac{1}{3x-1}\right]_1^2$	
	$= \left(\ln 2 - \ln 5 - \frac{1}{5}\right) - \left(\ln 1 - \ln 2 - \frac{1}{2}\right)$	M1
	$= \ln\frac{2\times 2}{5} + \ldots$	M1
	$= \frac{3}{10} + \ln\left(\frac{4}{5}\right)$	A1 **(6)**
		[10]

2.	$\frac{\mathrm{d}I}{\mathrm{d}t} = -16\ln(0.5)0.5^t$	M1 A1
	At $t = 3 \qquad \frac{\mathrm{d}I}{\mathrm{d}t} = -16\ln(0.5)0.5^3$	M1
	$= -2\ln 0.5 = \ln 4$	M1 A1
		[5]

Question Number	Scheme		Marks
3. (a)	$\left\{\sqrt{\left(\frac{1+x}{1-x}\right)}\right\} = (1+x)^{\frac{1}{2}}(1-x)^{-\frac{1}{2}}$	$(1+x)^{\frac{1}{2}}(1-x)^{-\frac{1}{2}}$	B1
	$= \left(1+\left(\frac{1}{2}\right)x+\frac{(\frac{1}{2})(-\frac{1}{2})}{2!}x^2+\ldots\right)\times\left(1+\left(-\frac{1}{2}\right)(-x)+\frac{(-\frac{1}{2})(-\frac{3}{2})}{2!}(-x)^2+\ldots\right)$		M1 A1 A1
	$= \left(1+\frac{1}{2}x-\frac{1}{8}x^2+\ldots\right)\times\left(1+\frac{1}{2}x+\frac{3}{8}x^2+\ldots\right)$		
	$= 1+\frac{1}{2}x+\frac{3}{8}x^2+\frac{1}{2}x+\frac{1}{4}x^2-\frac{1}{8}x^2+\ldots$		M1
	$= 1+x+\frac{1}{2}x^2$	*Answer is given in the question.*	A1 * **(6)**
(b)	$\sqrt{\left(\frac{1+(\frac{1}{26})}{1-(\frac{1}{26})}\right)} = 1+\left(\frac{1}{26}\right)+\frac{1}{2}\left(\frac{1}{26}\right)^2$		M1
	ie: $\frac{3\sqrt{3}}{5} = \frac{1405}{1352}$		B1
	so, $\sqrt{3} = \frac{7025}{4056}$	$\frac{7025}{4056}$	A1 **cao** **(3)** **[9]**

4.	$\int y\,\mathrm{d}y = \int \frac{3}{\cos^2 x}\mathrm{d}x$	Can be implied. Ignore integral signs	B1
	$= \int 3\sec^2 x\,\mathrm{d}x$		
	$\frac{1}{2}y^2 = 3\tan x \quad (+C)$		M1 A1
	$y=2, x=\frac{\pi}{4}$		
	$\frac{1}{2}2^2 = 3\tan\frac{\pi}{4}+C$		M1
	Leading to $C=-1$		
	$\frac{1}{2}y^2 = 3\tan x - 1$	or equivalent	A1 **(5)** **[5]**

Question Number		Scheme		Marks
5	(a)	Similar triangles $\Rightarrow \underline{\frac{r}{h}=\frac{16}{24}} \Rightarrow \underline{r=\frac{2h}{3}}$	Uses similar triangles, ratios or trigonometry to find either one of these two expressions oe.	M1
		$V=\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi\left(\frac{2h}{3}\right)^2 h = \frac{4\pi h^3}{27}$ **AG**	Substitutes $r=\frac{2h}{3}$ into the formula for the volume of water V.	A1 (2)
	(b)	From the question, $\frac{\mathrm{d}V}{\mathrm{d}t}=8$	$\frac{\mathrm{d}V}{\mathrm{d}t}=8$	B1
		$\underline{\frac{\mathrm{d}V}{\mathrm{d}h}=\frac{12\pi h^2}{27}=\frac{4\pi h^2}{9}}$	$\underline{\frac{\mathrm{d}V}{\mathrm{d}h}=\frac{12\pi h^2}{27}}$ or $\underline{\frac{4\pi h^2}{9}}$	B1
		$\frac{\mathrm{d}h}{\mathrm{d}t}=\frac{\mathrm{d}V}{\mathrm{d}t}\div\frac{\mathrm{d}V}{dh} = \underline{8\times\frac{9}{4\pi h^2}} = \underline{\frac{18}{\pi h^2}}$	Candidate's $\frac{\mathrm{d}V}{\mathrm{d}t}\div\frac{\mathrm{d}V}{\mathrm{d}h}$; $\underline{8\div\left(\frac{12\pi h^2}{27}\right)}$ or $\underline{8\times\frac{9}{4\pi h^2}}$ or $\underline{\frac{18}{\pi h^2}}$ oe	M1; A1
		When $h=12$, $\frac{\mathrm{d}h}{\mathrm{d}t} = \underline{\frac{18}{144\pi}} = \underline{\frac{1}{8\pi}}$	$\underline{\frac{18}{144\pi}}$ or $\underline{\frac{1}{8\pi}}$	A1 oe isw (5)
		Note the answer must be a one term exact value. Note, also you can ignore subsequent working after $\underline{\frac{18}{144\pi}}$.		**[7]**

Question Number	Scheme		Marks
6 (a)	$\int \tan^2 x \, \mathrm{d}x$		
	$\left[NB: \underline{\sec^2 A = 1 + \tan^2 A} \text{ gives } \underline{\tan^2 A = \sec^2 A - 1} \right]$	The correct underlined identity.	M1 oe
	$= \int \sec^2 x - 1 \, \mathrm{d}x$		
	$= \underline{\tan x - x} \, (+ c)$	Correct integration with/without + c	A1
			(2)
(b)	$\int \frac{1}{x^3} \ln x \, \mathrm{d}x$		
	$\left\{ \begin{array}{l} u = \ln x \quad \Rightarrow \quad \frac{\mathrm{d}u}{\mathrm{d}x} = \frac{1}{x} \\ \frac{\mathrm{d}v}{\mathrm{d}x} = x^{-3} \quad \Rightarrow \quad v = \frac{x^{-2}}{-2} = \frac{-1}{2x^2} \end{array} \right\}$		
	$= -\frac{1}{2x^2} \ln x - \int -\frac{1}{2x^2} . \frac{1}{x} \, \mathrm{d}x$	Use of 'integration by parts' formula in the correct direction. Correct direction means that $u = \ln x$.	M1
		Correct expression.	A1
	$= -\frac{1}{2x^2} \ln x + \frac{1}{2} \int \frac{1}{x^3} \, \mathrm{d}x$	An attempt to multiply through $\frac{k}{x^n}, n \in \mathbb{Z}, \ n \geqslant 2$ by $\frac{1}{x}$ and an attempt to ... … "integrate"(process the result);	M1
	$= \underline{-\frac{1}{2x^2} \ln x + \frac{1}{2} \left(-\frac{1}{2x^2} \right)} \, (+ c)$	correct solution with/without + c	A1 oe
			(4)

7.	(*a*)	$\frac{2}{4-y^2} \equiv \frac{2}{(2-y)(2+y)} \equiv \frac{A}{(2-y)} + \frac{B}{(2+y)}$ so $2 \equiv A(2+y) + B(2-y)$	M1
		Let $y=-2$, $2 = B(4) \Rightarrow B = \frac{1}{2}$, Let $y=2$, $2 = A(4) \Rightarrow A = \frac{1}{2}$	M1
		giving $\underline{\frac{\frac{1}{2}}{(2-y)} + \frac{\frac{1}{2}}{(2+y)}}$	A1 cao (3)
	(*b*)	$\int \frac{2}{4-y^2}\,\mathrm{d}y = \int \frac{1}{\cot x}\,\mathrm{d}x$	B1
		$\int \frac{\frac{1}{2}}{(2-y)} + \frac{\frac{1}{2}}{(2+y)}\,\mathrm{d}y = \int \tan x\,\mathrm{d}x$	
		$\therefore -\frac{1}{2}\ln(2-y) + \frac{1}{2}\ln(2+y) = \ln(\sec x) + (c)$	B1 M1 A1 ft
		$y=0, x=\frac{\pi}{3} \Rightarrow -\frac{1}{2}\ln 2 + \frac{1}{2}\ln 2 = \ln\left(\frac{1}{\cos\left(\frac{\pi}{3}\right)}\right) + c$	M1
		$\{0 = \ln 2 + c \Rightarrow \underline{c = -\ln 2}\}$	
		$-\frac{1}{2}\ln(2-y) + \frac{1}{2}\ln(2+y) = \ln(\sec x) - \ln 2$	
		$\frac{1}{2}\ln\left(\frac{2+y}{2-y}\right) = \ln\left(\frac{\sec x}{2}\right)$	M1
		$\ln\left(\frac{2+y}{2-y}\right) = 2\ln\left(\frac{\sec x}{2}\right)$	
		$\ln\left(\frac{2+y}{2-y}\right) = \ln\left(\frac{\sec x}{2}\right)^2$	M1
		$\frac{2+y}{2-y} = \frac{\sec^2 x}{4}$	
		Hence, $\underline{\sec^2 x = \frac{8+4y}{2-y}}$	A1 (8)
			(11 marks)

Question Number	Scheme	Marks
8.	(a) $\tan\theta = \sqrt{3}$ *or* $\sin\theta = \dfrac{\sqrt{3}}{2}$	M1
	$\theta = \dfrac{\pi}{3}$ awrt 1.05	A1 **(2)**
	(b) $\dfrac{\mathrm{d}x}{\mathrm{d}\theta} = \sec^2\theta$, $\dfrac{\mathrm{d}y}{\mathrm{d}\theta} = \cos\theta$	
	$\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{\cos\theta}{\sec^2\theta}$ $\left(=\cos^3\theta\right)$	M1 A1
	At P, $m = \cos^3\left(\dfrac{\pi}{3}\right) = \dfrac{1}{8}$ Can be implied	A1
	Using $mm' = -1$, $m' = -8$	M1
	For normal $y - \frac{1}{2}\sqrt{3} = -8\left(x - \sqrt{3}\right)$	M1
	At Q, $y = 0$ $-\frac{1}{2}\sqrt{3} = -8\left(x - \sqrt{3}\right)$	
	leading to $x = \frac{17}{16}\sqrt{3}$ $\left(k = \frac{17}{16}\right)$ 1.0625	A1 **(6)**
	(c) $\int y^2\,\mathrm{d}x = \int y^2 \dfrac{\mathrm{d}x}{\mathrm{d}\theta}\mathrm{d}\theta = \int \sin^2\theta\sec^2\theta\,\mathrm{d}\theta$	M1 A1
	$= \int \tan^2\theta\,\mathrm{d}\theta$	A1
	$= \int \left(\sec^2\theta - 1\right)\mathrm{d}\theta$	M1
	$= \tan\theta - \theta$ $\left(+C\right)$	A1
	$V = \pi\int_0^{\frac{\pi}{3}} y^2\,\mathrm{d}x = \left[\tan\theta - \theta\right]_0^{\frac{\pi}{3}} = \pi\left[\left(\sqrt{3} - \frac{\pi}{3}\right) - \left(0 - 0\right)\right]$	M1
	$= \sqrt{3}\pi - \frac{1}{3}\pi^2$ $\left(p = 1, q = -\frac{1}{3}\right)$	A1 **(7)**
		[15]

Statistics for C4 Practice Paper G2

				Mean score for students achieving grade:							
Qu	**Max score**	**Modal score**	**Mean %**	**ALL**	**A***	**A**	**B**	**C**	**D**	**E**	**U**
1	10		75	7.47	9.68	8.85	7.82	6.62	5.31	3.97	2.22
2	5		57	2.83	4.71	3.30	2.12	1.36	0.94	0.90	0.67
3	9	9	59	5.28	8.16	6.52	5.28	4.26	3.4	2.61	1.64
4	5		57	2.86	4.81	4.10	3.00	1.70	0.81	0.30	0.08
5	7		47	3.26		5.18	2.52	1.20	0.65	0.20	0.11
6	13		55	7.18		10.02	5.96	3.82	2.50	1.38	0.40
7	11		46	5.05		7.44	4.70	3.12	2.10	1.42	0.83
8	15		52	7.86	14.16	10.39	7.32	4.95	3.34	2.04	1.10
	75		**56**	**41.79**		**55.80**	**38.72**	**27.03**	**19.05**	**12.82**	**7.05**