Edexcel GCE
Core Mathematics C3
Gold Level G1
(Mark Scheme)

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Question Number	Scheme	Marks
1. (*a*)	$e^{2x+1} = 2$	
	$2x+1 = \ln 2$	M1
	$x = \frac{1}{2}(\ln 2 - 1)$	A1 (2)
(*b*)	$\frac{dy}{dx} = 8e^{2x+1}$	B1
	$x = \frac{1}{2}(\ln 2 - 1) \Rightarrow \frac{dy}{dx} = 16$	B1
	$y - 8 = 16\left(x - \frac{1}{2}(\ln 2 - 1)\right)$	M1
	$y = 16x + 16 - 8\ln 2$	A1 (4)
		(6 marks)

Question Number	Scheme	Marks
2.	At P, $y = \underline{3}$	B1
	$\frac{dy}{dx} = \underline{3(-2)(5-3x)^{-3}(-3)}$ $\left\{\text{or } \frac{18}{(5-3x)^3}\right\}$	M1<u>A1</u>
	$\frac{dy}{dx} = \frac{18}{(5-3(2))^3}$ $\{= -18\}$	M1
	$m(\mathbf{N}) = \frac{-1}{-18}$ or $\frac{1}{18}$	M1
	$\mathbf{N}$: $y - 3 = \frac{1}{18}(x-2)$	M1
	$\mathbf{N}$: $\underline{x - 18y + 52 = 0}$	A1
		[7]

Question Number	Scheme	Marks
3. (*a*)	$\frac{dy}{dx} = x^2e^x + 2xe^x$	M1,A1,A1 (3)
(*b*)	If $\frac{dy}{dx} = 0$, $e^x(x^2 + 2x) = 0$ setting (*a*) = 0 $[e^x \neq 0]$ $x(x + 2) = 0$ $(x = 0)$ $x = -2$ $x = 0, y = 0$ **and** $x = -2, y = 4e^{-2}$ $(= 0.54\ldots)$	M1 A1 A1 √ (3)
(*c*)	$\frac{d^2y}{dx^2} = x^2e^x + 2xe^x + 2xe^x + 2e^x$ $\left[= (x^2 + 4x + 2)e^x\right]$	M1, A1 (2)
(*d*)	$x = 0$, $\frac{d^2y}{dx^2} > 0$ (=2) $x = -2$, $\frac{d^2y}{dx^2} < 0$ $[= -2e^{-2}$ $(= -0.270\ldots)]$ M1: Evaluate, or state sign of, candidate's (c) for at least one of candidate's *x* value(s) from (b) $\therefore$ minimum $\therefore$ maximum	M1 A1 (cso) (2) **(10 marks)**

Question Number	Scheme	Marks
Q4 (i)	$y = \dfrac{\ln(x^2+1)}{x}$	
	$u = \ln(x^2+1) \quad \Rightarrow \dfrac{du}{dx} = \dfrac{2x}{x^2+1}$	M1 A1
	Apply quotient rule: $\left\{\begin{array}{ll} u = \ln(x^2+1) & v = x \\ \dfrac{du}{dx} = \dfrac{2x}{x^2+1} & \dfrac{dv}{dx} = 1 \end{array}\right\}$	
	$\dfrac{dy}{dx} = \dfrac{\left(\dfrac{2x}{x^2+1}\right)(x) - \ln(x^2+1)}{x^2}$	M1 A1 (4)
	$\left\{\dfrac{dy}{dx} = \dfrac{2}{(x^2+1)} - \dfrac{1}{x^2}\ln(x^2+1)\right\}$	
(ii)	$x = \tan y$ $\dfrac{dx}{dy} = \sec^2 y$	M1* A1
	$\dfrac{dy}{dx} = \dfrac{1}{\sec^2 y} \quad \{= \cos^2 y\}$	dM1*
	$\dfrac{dy}{dx} = \dfrac{1}{1+\tan^2 y}$	dM1*
	Hence, $\dfrac{dy}{dx} = \dfrac{1}{1+x^2}$, (as required)	A1 **AG** (5) **[9]**

Question Number		Scheme	
5.	(a)	Either $y = 2$ or $(0, 2)$	B1 (1)
	(b)	When $x = 2$, $y = (8 - 10 + 2)e^{-2} = 0e^{-2} = 0$	B1
		$(2x^2 - 5x + 2) = 0 \Rightarrow (x-2)(2x-1) = 0$	M1
		Either $x = 2$ (for possibly B1 above) or $\underline{x = \frac{1}{2}}$.	A1 (3)
	(c)	$\frac{dy}{dx} = (4x-5)e^{-x} - (2x^2 - 5x + 2)e^{-x}$	M1A1A1 (3)
	(d)	$(4x-5)e^{-x} - (2x^2 - 5x + 2)e^{-x} = 0$	M1
		$2x^2 - 9x + 7 = 0 \Rightarrow (2x - 7)(x - 1) = 0$	M1
		$x = \frac{7}{2}, 1$	A1
		When $x = \frac{7}{2}$, $y = 9e^{-\frac{7}{2}}$, when $x = 1$, $y = -e^{-1}$	ddM1A1 (5) **[12]**

Question Number		Scheme	Marks
6.	(*a*)	Complete method for R: e.g. $R\cos\alpha = 3$, $R\sin\alpha = 2$, $R = \sqrt{(3^2 + 2^2)}$	M1
		$R = \sqrt{13}$ or 3.61 (or more accurate)	A1
		Complete method for $\tan\alpha = \frac{2}{3}$ [Allow $\tan\alpha = \frac{3}{2}$]	M1
		$\alpha = 0.588$ (Allow 33.7°)	A1 (4)
	(*b*)	Greatest value $= \left(\sqrt{13}\right)^4 = 169$	M1, A1 (2)
	(*c*)	$\sin(x + 0.588) = \frac{1}{\sqrt{13}}$ (= 0.27735…) $\sin(x + \text{their } \alpha) = \frac{1}{\text{their } R}$	M1
		$(x + 0.588) = 0.281(03\ldots)$ or 16.1°	A1
		$(x + 0.588) = \pi - 0.28103\ldots$	M1
		Must be $\pi -$ their 0.281 or 180° – their 16.1°	
		or $(x + 0.588) = 2\pi + 0.28103\ldots$	M1
		Must be $2\pi +$ their 0.281 or 360° + their 16.1°	
		$x = 2.273$ or $x = 5.976$ (awrt) Both (radians only)	A1 (5)
		If 0.281 or 16.1° not seen, correct answers imply this A mark	**(11 marks)**

Question Number	Scheme	Marks
7. (a)	$4\operatorname{cosec}^2 2\theta - \operatorname{cosec}^2\theta = \dfrac{4}{\sin^2 2\theta} - \dfrac{1}{\sin^2\theta}$	
	$= \dfrac{4}{(2\sin\theta\cos\theta)^2} - \dfrac{1}{\sin^2\theta}$	B1 B1
		(2)
(b)	$\dfrac{4}{(2\sin\theta\cos\theta)^2} - \dfrac{1}{\sin^2\theta} = \dfrac{4}{4\sin^2\theta\cos^2\theta} - \dfrac{1}{\sin^2\theta}$	
	$= \dfrac{1}{\sin^2\theta\cos^2\theta} - \dfrac{\cos^2\theta}{\sin^2\theta\cos^2\theta}$	M1
Using $1-\cos^2\theta = \sin^2\theta$	$= \dfrac{\sin^2\theta}{\sin^2\theta\cos^2\theta}$	M1
	$= \dfrac{1}{\cos^2\theta} = \sec^2\theta$	M1A1*
		(4)
(c)	$\sec^2\theta = 4 \Rightarrow \sec\theta = \pm 2 \Rightarrow \cos\theta = \pm\dfrac{1}{2}$	M1
	$\theta = \dfrac{\pi}{3}, \dfrac{2\pi}{3}$	A1,A1
		(3)
		(9 marks)

Question number	Scheme	Marks
8. (a)	$\tan(A+B)=\frac{\sin(A+B)}{\cos(A+B)}=\frac{sinAcosB+cosAsinB}{cosAcosB-sinAsinB}$	M1A1
	$=\frac{\frac{sinA}{cosA}+\frac{sinB}{cosB}}{1-\frac{sinAsinB}{cosAcosB}}$	M1
	$(\div cosAcosB)$	
	$=\frac{tanA+tanB}{1-tanAtanB}$	A1 *
		(4)
(b)	$\tan\left(\theta+\frac{\pi}{6}\right)=\frac{tan\theta+\frac{\tan\pi}{6}}{1-\frac{tan\theta\tan\pi}{6}}$	M1
	$=\frac{tan\theta+\frac{1}{\sqrt{3}}}{1-tan\theta\frac{1}{\sqrt{3}}}$	M1
	$=\frac{\sqrt{3tan\theta}+1}{\sqrt{3}-tan\theta}$	A1 *
		(3)
(c)	$\tan\left(\theta+\frac{\pi}{6}\right)=\tan(\pi-\theta).$	M1
	$\left(\theta+\frac{\pi}{6}\right)=(\pi-\theta)$	M1
	$\theta=\frac{5}{12}\pi$	M1 A1
	$\tan\left(\theta+\frac{\pi}{6}\right)=\tan(2\pi-\theta)$	M1
	$\theta=\frac{11}{12}\pi$	A1
		(6)
		(13 marks)

Statistics for C3 Practice Paper G1

				Mean score for students achieving grade:							
Qu	**Max score**	**Modal score**	**Mean %**	**ALL**	**A***	**A**	**B**	**C**	**D**	**E**	**U**
1	6		69	4.15		5.31	4.48	3.77	2.97	2.12	1.01
2	7		76	5.30	6.72	6.24	5.74	5.12	4.22	2.99	1.55
3	10		73	7.34		9.12	7.87	6.78	5.51	4.09	2.18
4	9		60	5.38		7.70	6.17	4.83	3.74	2.42	1.21
5	10		61	6.05	8.91	7.66	6.22	4.88	3.75	2.77	1.66
6	11		62	6.84		9.40	7.47	5.74	3.99	2.44	0.99
7	9		57	5.09	8.65	6.98	5.04	3.59	2.44	1.60	0.76
8	13		51	6.63	12.08	9.66	7.53	5.97	4.35	3.19	1.60
	75		**62**	**46.78**		**62.07**	**50.52**	**40.68**	**30.97**	**21.62**	**10.96**