EDEXCEL CORE MATHEMATICS C4 **PRACTICE PAPER A4 MARK SCHEME**

Question Number	Scheme	Marks
1. (*a*)	$10x, +(2y + 2x\frac{dy}{dx}), -6y\frac{dy}{dx} = 0$	M1, (B1), A1
	At (1 , 2) $\quad 10 + (4 + 2\frac{dy}{dx}) - 12\frac{dy}{dx} = 0$	M1
	$\therefore \frac{dy}{dx} = \frac{14}{10} = 1.4$ *or* $\frac{7}{5}$ *or* $1\frac{2}{5}$	A1 (5)
(*b*)	The gradient of the normal is $-\frac{5}{7}$	M1
	Its equation is $y - 2 = -\frac{5}{7}(x - 1)$ (allow tangent)	M1
	$y = -\frac{5}{7}x + 2\frac{5}{7}$ or $y = -\frac{5}{7}x + \frac{19}{7}$	A1cao (3)
		(8 marks)
2.	$[f(x)]^2 = x^2 + \frac{4}{x^4} + \frac{4}{x}$	M1
	$\int [f(x)]^2 dx = \left[\frac{x^3}{3} - \frac{4}{3x^3} + 4\ln x\right]$	M1 A1 B1
	$\int_1^2 [f(x)]^2 dx = \left(\frac{8}{3} - \frac{4}{24} + 4\ln 2\right) - \left(\frac{1}{3} - \frac{4}{3} + 4\ln 1\right)$	M1
	$\left(= \frac{7}{2} + 4\ln 2\right)$	
	$V = \pi \int_1^2 [f(x)]^2 \quad dx \Rightarrow V = \pi\left(\frac{7}{2} + \ln 16\right)$ or $a = \frac{7}{2}$, $b = 16$	M1 A1 A1
		(8 marks)

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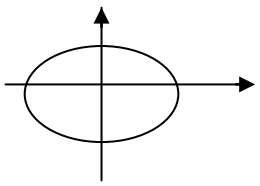
3. (*a*)	x 0 $\frac{\pi}{6}$ $\frac{\pi}{3}$ $\frac{\pi}{2}$ 1, 0	B1
	y 1 1.46 1.42 0 1.146, 1.42	B1, B1 (3)
(*b*)	$I \approx \frac{1}{2}\left(\frac{\pi}{6}\right)\ldots$	B1
	$\approx \ldots\left(1+2\left(1.46+1.42\right)+0\right)$	M1 A1 ft
	≈ 1.8	A1 (4)
(*c*)	underestimates	B1
	diagram or explanation	B1 (2)
	NB. Exact answer is $\frac{1}{2}\left(\mathrm{e}^{\frac{\pi}{2}}-1\right)\approx 1.905\ldots$	**(9 marks)**
4. (*a*)	$5\cos t = 0 : t = \frac{\pi}{2},\ y = 2$ (0, 2) $t = \frac{3\pi}{2}, y = -6$ (0, –6)	M1 A1
	$4\sin t = 2 : t = \frac{\pi}{6},\ x = \frac{5\sqrt{3}}{2}$ $t = \frac{5\pi}{6},\ x = -\frac{5\sqrt{3}}{2}$ $(\pm\frac{5\sqrt{3}}{2}, 0)$	M1 A1 (4)
(*b*)	 shape	B1
	position	B1 (2)
	$\frac{\mathrm{d}x}{\mathrm{d}t} = -5\sin t,\ \frac{\mathrm{d}y}{\mathrm{d}t} = 4\cos t,\quad \frac{\mathrm{d}y}{\mathrm{d}x} = \frac{-4\cos t}{5\sin t}$	M1 A1
(*c*)	$y = \frac{5\tan\frac{\pi}{6}}{4}(x - \frac{5\sqrt{3}}{2})$, i.e. $8\sqrt{3}y = 10x - 25\sqrt{3}$ ★	M1 A1 (4)
		(10 marks)

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5. (*a*)	$f'(x) = 0$ for maximum (or stationary point or turning point)	B1
	$f'(1.48) = e^{1.48} - 2\times 1.48^2 = 0.0121\ldots$	M1
	$f'(1.49) = = -0.0031\ldots$	
	change of sign $\therefore$ root / maximum in range	A1
		(3)
(*b*)	$y = e^x - \frac{2}{3}x^3 \ (+c)$	M1 A1
	at $(0, 5)$ $5 = e^0 - 0 + c$	M1
	$\underline{c = 4}$ $\left(y = e^x - \frac{2}{3}x^3 + 4\right)$ $(c = 4)$	A1
		(4)
(*c*)	Area $= \int_0^2 \left(e^x - \frac{2}{3}x^3 + 4\right) dx$	M1
	$= \left[e^x - \frac{2}{12}x^4 + 4x\right]_0^2$	A1
	$= \left(e^2 - \frac{16}{6} + 8\right) - (e^0 - 0 + 0)$	M1
	$= \underline{\underline{e^2 + 4\frac{1}{3} \ \ or \ \ e^2 + \frac{13}{3}}}$	A1 cao
		(4)
		(11 marks)

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Question Number		Scheme	Marks
6.	(*a*)	$na = -6, \quad \frac{n(n-1)}{2}a^2 = 27$	B1 B1
		Attempts solution by eliminating variable	
		e.g. $\frac{n(n-1)36}{n^2} = 54$ or $-\frac{6}{a}(-\frac{6}{a}-1)a^2 = 54$	M1
		$n = -2, \quad a = 3$	A1 A1 (5)
	(*b*)	$\frac{(-2)(-3)(-4)3^3}{6} = -108$ for M1 allow a instead of a^3	M1 A1 (2)
	(*c*)	$\lvert x \rvert < \frac{1}{3}$ or $-\frac{1}{3} < x < \frac{1}{3}$	B1 ft (1)
7.	(*a*)	$1 \times 4 - 2 \times 1 - 2 \times 1 = 0$, i.e. $\begin{pmatrix} 1 \\ -2 \\ 2 \end{pmatrix} . \begin{pmatrix} 4 \\ 1 \\ -1 \end{pmatrix} = 0$, therefore perpendicular.	M1 A1 (2)
	(*b*)	$3 + \lambda = 9 + 4\mu$	M1
		and *either* $4 - 2\lambda = 1 + \mu$ *or* $-5 + 2\lambda = -2 - \mu$	A1
		Eliminate to obtain $\mu = -1$ or $\lambda = 2$	M1 A1
		Point is (5, 0, –1) Vector is $\begin{pmatrix} 5 \\ 0 \\ -1 \end{pmatrix}$	B1 (5)
	(*c*)	$\lambda = -3 \Rightarrow$ point lies on first line l_1	M1 A1
		show contradiction for $\mu \Rightarrow$ point not on l_2	B1 (3)
	(*d*)	$\sqrt{(5^2 + 10^2 + 10^2)} = 15 \Rightarrow 1.5$ km	M1 A1 (2)
			(12 marks)

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Question Number		Scheme	Marks
8.	(*a*)	$\int \frac{\mathrm{d}x}{(1-2x)(1-4x)} = \int k \quad \mathrm{d}t$	B1
		$\int \frac{-1}{1-2x} + \frac{2}{1-4x}\mathrm{d}x = \int k \quad \mathrm{d}t$	M1 A1
		$\frac{1}{2}\ln(1-2x) - \frac{1}{2}\ln(1-4x) = kt\ (+\frac{1}{2}c)$	M1 A1 A1
		$\ln\frac{1-2x}{1-4x} = 2kt + c \quad (*)$	A1 cso (7)
	(*b*)	Use $x = 0$ when $t = 0 \Rightarrow c = 0$	B1
		$\therefore \frac{1-2x}{1-4x} = \mathrm{e}^{2kt}$	M1
		$\therefore x(4\mathrm{e}^{2kt} - 2) = \mathrm{e}^{2kt} - 1, \quad \therefore x = \frac{\mathrm{e}^{2kt} - 1}{4\mathrm{e}^{2kt} - 2}$	M1 A1 (4)
	(*c*)	As $t \to \infty$, $x \to \frac{1}{4}$	M1 A1 (2)
			(13 marks)