EDEXCEL CORE MATHEMATICS C4 PRACTICE PAPER A6 MARK SCHEME

Question Number	Scheme	Marks
1. (*a*)	$1.5 \sin 2x + 2 \cos 2x = R \sin (2x + \alpha) = R[\sin 2x \cos \alpha + \cos 2x \sin \alpha]$	
	$R = \sqrt{1.5^2 + 2^2} = 2.5$ Full method for R or R^2	M1, A1
	$\tan\alpha = \frac{2}{1.5}, \Rightarrow \alpha = 0.927$ Full method for $\tan \alpha$, $\sin \alpha$, $\cos \alpha$	M1, A1 (4)
(*b*)	$3 \sin x \cos x = 1.5 \sin 2x$	M1
	$4 \cos^2 x = 2[2 \cos^2 x] = 2(\cos 2x + 1)$	
	$\therefore 3 \sin x \cos x + 4 \cos^2 x = 1.5 \sin 2x + 2 \cos 2x + 2$	A1 (2)
(*c*)	Maximum value of $1.5 \sin 2x + 2 \cos 2x = R$	M1
	Maximum value of $3 \sin x \cos x + 4 \cos^2 x = R + 2$ or 4.5	A1 ft (2)
		(8 marks)
2. (*a*)	$x^2 + 1 \equiv A(1+x)(3-x) + B(3-x) + C(1+x)$; $A = -1$	B1
	$2 = 4B$, $B = \frac{1}{2}$; $10 = 4C$, $C = \frac{5}{2}$	M1 A1; A1 (4)
(*b*)	$\int (-1 + \frac{1}{2(1+x)} + \frac{5}{2(3-x)})\mathrm{d}x$	
	$= -x + \frac{1}{2}\ln(1+x) - \frac{5}{2}\ln(3-x)$	M1A1✓A1✓
	$\int_0^2 \mathrm{f}(x) = (-2 + \frac{1}{2}\ln 3) - (-\frac{5}{2}\ln 3) = -2 + 3\ln 3$	M1A1 (5)
		(9 marks)

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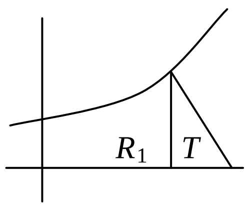
3. (*a*)	4, 4.84, 7.06	B2/1/0 (2)
(*b*)	$I \approx \frac{1}{2}\times 0.25\left[6.06+7.06+2\left(4.32+4+4.84\right)\right]$	B1 [M1 A1]
	$=\frac{1}{2}\times 0.25[39.44]$	
	= 4.93 or 4.9 (AWRT 4.93 or just 4.9)	A1 (4)
(*c*)	$\int_{0.5}^{1.5}\left(\frac{3}{x}+x^4\right)dx = \left[3\ln x+\frac{1}{5}x^5\right]_{0.5}^{1.5}$	M1 A1
	$=\left(3\ln 1.5+\frac{1}{5}1.5^5\right)-\left(3\ln 0.5+\frac{1}{5}0.5^5\right)$	M1
	$=3\ln 3+1.5125$ or $3\ln 3+\frac{121}{80}$	A1 (4)
(*d*)	$\frac{[4.93-(c)]\times 100}{(c)}$, = 2.53% (i.e < 3%) AWRT 2.5%	M1, A1 (2)
		(12 marks)
4. (*a*)	Area of triangle = $\frac{1}{2}\times 30\times 3\pi^2$ (= 444.132) Accept 440 or 450	B1 (1)
(*b*)	Area shaded = $\int_{\frac{\pi}{4}}^{\frac{\pi}{2}} 30\sin 2t.32t\,dt$	M1 A1
	$=\left[-480t\cos 2t+\int 480\cos 2t\right]_{\frac{\pi}{4}}^{\frac{\pi}{2}}$	M1 A1
	$=\left[-480t\cos 2t+240\sin 2t\right]_{\frac{\pi}{4}}^{\frac{\pi}{2}}$	A1 ft
	$= 240(\pi-1)$	M1A1 (7)
(*c*)	Percentage error = $\frac{240(\pi-1)-estimate}{240(\pi-1)}\times 100 = 13.6\%$ (Accept answers in the range 12.4% to 14.4%)	M1 A1 (2)
		(10 marks)
5. (a)	$(1+\frac{5}{15})^{-\frac{1}{2}}=(\frac{4}{3})^{-\frac{1}{2}}$, $=(\frac{3}{4})^{\frac{1}{2}}=\frac{\sqrt{3}}{2}; =\sin 60°$	M1,A1;A1 (3)
	$1+5x(-\frac{1}{2})+\frac{(5x)^2}{2}(-\frac{1}{2})(-\frac{3}{2})+\frac{(5x)^3}{6}(-\frac{1}{2})(-\frac{3}{2})(-\frac{5}{2})\ldots$	M1,
(*b*)	$=1-\frac{5}{2}x,+\frac{75}{8}x^2,-\frac{625}{16}x^3\ldots$	B1, A1, A1 (4)
(*c*)	$=1-\frac{5}{2}\left(\frac{1}{15}\right),+\frac{75}{8}\left(\frac{1}{15}\right)^2,-\frac{625}{16}\left(\frac{1}{15}\right)^3\ldots =0.863(4259..)$	M1 A1 (2)
(*d*)	$\sin 60° - (\text{Ans}) \approx 0.0026$	A1 (1)
		(10 marks)

Question Number	Scheme	Marks
6. (*a*)	$x \tan x, -\int \tan x \, dx$	M1, A1
	$= x \tan x + [\ln \cos x]$ (or equivalent)	[M1 A1]
	$= \frac{\pi}{4} + \ln \cos \frac{\pi}{4}$	M1
	$= \frac{\pi}{4} + \ln \frac{1}{\sqrt{2}} = \frac{\pi}{4} - \frac{1}{2} \ln 2$ *	M1 (6)
(*b*)	$V = \pi \int_0^{\frac{\pi}{4}} x \sec^2 x \, dx$	M1
	$= \frac{\pi^2}{4} - \frac{\pi}{2} \ln 2 = 1.38$	A1 (2)
(*c*)	$\frac{dy}{dx} = \frac{1}{2} x^{-\frac{1}{2}} \sec x + x^{\frac{1}{2}} \sec x \tan x$	M1 A1
	2.05	A1 (3)
		(11 marks)
7. (*a*)	M is (0, 7)	B1
	$\frac{dy}{dx} = 2e^x$ Attempt $\frac{dy}{dx}$	M1
	$\therefore$ gradient of normal is $-\frac{1}{2}$ ft their $y'(0)$	M1
	$\therefore$ equation of normal is $y - 7 = -\frac{1}{2}(x - 0)$ or $x + 2y = 14$	A1 (4)
(*b*)	$y = 0, x = 14$ $\therefore$ N is (14, 0) (*)	B1 cso (1)
(*c*)	 $\int (2e^x + 5) \, dx = [2e^x + 5x]$ some correct $\int$	M1
	$R_1 = \int_0^{\ln 4} (2e^x + 5) \, dx = (2 \times 4 + 5 \ln 4) - (2 + 0)$	M1 limits used
	$= 6 + 5 \ln 4$	A1
	$T = \frac{1}{2} \times 13 \times (14 - \ln 4)$ Area of T	B1
	$T = 13(7 - \ln 2)$; $R_1 = 6 + 10 \ln 2$ Use of $\ln 4 = 2 \ln 2$	B1
	$R = T + R_1$, $R = 97 - 3 \ln 2$	M1, A1 (7)
		(12marks)

Question Number	Scheme	Marks
8. (*a*)	$\mathbf{r} = (9\mathbf{i} - 2\mathbf{j} + \mathbf{k}) + \lambda(-3\mathbf{i} + 4\mathbf{j} + 5\mathbf{k})$ (or any correct alternative)	M1,A1 (2)
(*b*)	Uses their line equation, or recognises B is mid point of AC or merely writes down *p*=6, *q*=11	M1, A1 (2)
(*c*)	Calculates $\overrightarrow{OC} \bullet \overrightarrow{AB}$	M1
	Uses $\cos\alpha = \frac{OC \bullet AB}{\lvert OC\rvert \lvert AB\rvert}$ to obtain α.	M1
	$\cos\alpha = \frac{70}{\sqrt{166}\sqrt{50}}$, $\alpha = 39.8^\circ$ (accept 39.79 or 40)	A1 (3)
(*d*)	Let *OD* be $(9\mathbf{i} - 2\mathbf{j} + \mathbf{k}) + t(-3\mathbf{i} + 4\mathbf{j} + 5\mathbf{k})$	M1
	Use scalar product *OD*. *AB*=0	M1
	Obtains equation in *t* and solves to obtain *t* = 0.6 (or equivalent)	M1A1
	Uses their *t*, to obtain 7.2 **i** + 0.4 **j** + 4**k**.	M1, A1 (6)
		(13marks)