Question number	Scheme	Marks
1.	$(4-3x)^{-\frac{1}{2}} = 4^{-\frac{1}{2}}\left(1-\frac{3}{4}x\right)^{-\frac{1}{2}}$ $= \frac{1}{2}\left(1+\frac{3}{8}x+\frac{\left(-\frac{1}{2}\right)\left(-\frac{3}{2}\right)\left(-\frac{3}{4}x\right)^2}{2}+\frac{\left(-\frac{1}{2}\right)\left(-\frac{3}{2}\right)\left(-\frac{5}{2}\right)\left(-\frac{3}{4}x\right)^3}{6}+.....\right)$ $= \frac{1}{2}+\frac{3}{16}x,+\frac{27}{256}x^2,+\frac{135}{2048}x^3.......$	B1 M1 A1, A1, A1 **(5 marks)**
2.	$26x + 26yy'\,;\,-10xy'-10y = 0$ $y'(26y-10x) = 10y-26x$ $y' = \dfrac{10y-26x}{26y-10x} = \dfrac{5y-13x}{13y-5x}$	M1A1; M1A1 M1 A1 **(6 marks)**
3.	$x = \tan\theta \qquad \dfrac{dx}{d\theta} = \sec^2\theta \Rightarrow I = \displaystyle\int \dfrac{\sec^2\theta}{\sec^4\theta}\,d\theta$ Limits $\dfrac{\pi}{4}$ and 0 $I = \displaystyle\int\cos^2\theta\;d\theta = \int\dfrac{\cos 2\theta+1}{2}\,d\theta$ $= \left[\dfrac{\sin 2\theta}{4}+\dfrac{\theta}{2}\right]_0^{\frac{\pi}{4}}$ $= \dfrac{1}{4}+\dfrac{\pi}{8} \qquad (*)$	M1 A1 B1 M1 A1 M1 A1 A1 cao **(8 marks)**

Question number	Scheme	Marks
4. (a)	$\dfrac{dx}{dt} = \sec^2 t \qquad \dfrac{dy}{dt} = 2\cos 2t, \Rightarrow \dfrac{dy}{dx} = \dfrac{2\cos 2t}{\sec^2 t}$	M1 A1, $\Rightarrow$ M1
	When $t = \dfrac{\pi}{3}$ gradient is $-\dfrac{1}{4}$	B1 (4)
(b)	$y - \dfrac{\sqrt{3}}{2} = -\dfrac{1}{m}(x - \sqrt{3})$ \hspace{2cm} P has coordinates $(\sqrt{3}, \dfrac{\sqrt{3}}{2})$	B1
	$y - \dfrac{\sqrt{3}}{2} = 4(x - \sqrt{3})$	M1
	$y = 4x - \dfrac{7}{2}\sqrt{3}$	A1 (3)
(c)	$\dfrac{dy}{dx} = 0 \Rightarrow$ gradient of tan $= 0$, gradient of normal undefined	M1
	$\therefore x = \tan\dfrac{\pi}{4}$, i.e: $x = 1$	A1 (2)
		(9 marks)
5. (a)	$5 + \lambda = 2 - 3\mu, \qquad 3 - 2\lambda = -11 - 4\mu$	B1 B1
	$\therefore \lambda + 3\mu + 3 = 0$	
	$2\lambda - 4\mu - 14 = 0$	
	$2\lambda + 6\mu + 6 = 0$	
	$10\mu + 20 = 0 \Rightarrow \mu = -2 \therefore \lambda = 3$	M1 A1
	$\therefore$ point is $(8, -3, 4)$	A1 (5)
(b)	$\therefore a - 10 = 4 \qquad \Rightarrow a = 14$	M1 A1 (2)
(c)	$\cos\theta = \dfrac{-3 + 8 + 10}{\sqrt{9}\sqrt{25 + 25}}$	M1 A1
	$\qquad = \dfrac{15}{3 \times 5\sqrt{2}} \qquad\qquad = \dfrac{1}{\sqrt{2}}$	
	Angle $= 45°$	M1 A1 (4)
		(11 marks)

Question number	Scheme	Marks
6. (a)	$11x - 1 \equiv A(2 + 3x) + B(1 - x)(2 + 3x) + C(1 - x)^2$	
	Putting $x = 1 \Rightarrow A = 2$	B1
	Putting $x = -\dfrac{2}{3} \Rightarrow -\dfrac{25}{3} = \dfrac{25}{9}C \qquad \Rightarrow C = -3$	B1
	cf x^2 $\qquad\qquad 0 = -3B + C \Rightarrow B = -1$	M1A1 (4)
(b)	$\displaystyle\int_0^{\frac{1}{2}} \dfrac{2}{(1-x)^2} - \dfrac{1}{(1-x)} - \dfrac{3}{(2+3x)} \; \mathrm{d}x$	
	$= \left[\dfrac{2}{1-x} + \ln|1-x| - \ln|2+3x| \right]$	M1 A1ft A1ft A1ft
	$= [4 + \ln\frac{1}{2} - \ln 3\frac{1}{2} - (2 - \ln 2)]$	M1
	$= 2 + \ln \dfrac{\frac{1}{2}\times 2}{3\frac{1}{2}}$	M1
	$= 2 + \ln \frac{2}{7}$	A1 (7)
		(11 marks)
7. (a)	$\dfrac{\mathrm{d}u}{\mathrm{d}x} = \frac{1}{2} - \frac{1}{2}\cos 4x; = \frac{1}{2} - \frac{1}{2}(1 - 2\sin^2 2x) = \sin^2 2x$	M1 A1; M1 A1 (4)
(b)	$V = \pi \displaystyle\int x \sin^2 2x \; \mathrm{d}x$	M1
	$= \pi\left[x\left(\dfrac{x}{2} - \dfrac{1}{8}\sin 4x\right) - \displaystyle\int \dfrac{x}{2} - \dfrac{1}{8}\sin 4x \, \mathrm{d}x \right]_0^{\frac{\pi}{4}}$	M1 A1 A1
	$= \pi\left[\dfrac{x^2}{2} - \dfrac{x}{8}\sin 4x - \left(\dfrac{x^2}{4} + \dfrac{1}{32}\cos 4x\right) \right]_0^{\frac{\pi}{4}}$	M1 A1
	$= \pi\left[\dfrac{\pi^2}{64} + \dfrac{1}{32} + \dfrac{1}{32} \right] = \pi\left[\dfrac{\pi^2}{64} + \dfrac{1}{16} \right]$	M1 A1 (8)
		(12 marks)

Question number	Scheme	Marks
8. (a)	$\dfrac{\mathrm{d}r}{\mathrm{d}t} = \dfrac{k}{r^2}$	B1
	$A = \pi r^2 \qquad \therefore \dfrac{\mathrm{d}A}{\mathrm{d}r} = 2\pi r$	M1A1
	$\therefore \dfrac{\mathrm{d}A}{\mathrm{d}t} = 2\pi r\,\dfrac{k}{r^2} = \dfrac{(2\pi k)}{r}\,; = \dfrac{(2\pi k)}{\left(\dfrac{A}{\pi}\right)^{\frac{1}{2}}} = \dfrac{2\pi^{\frac{3}{2}}k}{\sqrt{A}}$	M1; M1
	$\therefore \dfrac{\mathrm{d}A}{\mathrm{d}t} \propto \dfrac{1}{\sqrt{A}}$ (*)	A1 (6)
(b)	$\displaystyle\int \sqrt{S}\,\mathrm{d}S = \int 2e^{2t}\,\mathrm{d}t$	M1
	$\dfrac{2}{3}S^{\frac{3}{2}} = e^{2t} + C$	M1A1
	$t = 0,\ S = 9 \qquad \Rightarrow C = 17$	B1
	$\therefore \dfrac{2}{3}S^{\frac{3}{2}} = e^{2t} + 17$ and use $S = 16$	M1
	$\left(\dfrac{128}{3} - 17\right) = e^{2t} \qquad\qquad \Rightarrow t = \dfrac{1}{2}\ln\left[\dfrac{77}{3}\right]$	M1
	$= 1.6$	A1 (7)
		(13 marks)