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

Question number	Scheme	Marks
4. (a)	$\frac{dx}{dt} = \sec^2 t$ $\quad \frac{dy}{dt} = 2\cos 2t, \Rightarrow \frac{dy}{dx} = \frac{2\cos 2t}{\sec^2 t}$	M1 A1, ⇒ M1
	When $t = \frac{\pi}{3}$ gradient is $-\frac{1}{4}$	B1 (4)
(b)	$y - \frac{\sqrt{3}}{2} = -\frac{1}{m}(x - \sqrt{3})$ $\quad$ P has coordinates $(\sqrt{3}, \frac{\sqrt{3}}{2})$	B1
	$y - \frac{\sqrt{3}}{2} = 4(x - \sqrt{3})$	M1
	$y = 4x - \frac{7}{2}\sqrt{3}$	A1 (3)
(c)	$\frac{dy}{dx} = 0 \Rightarrow$ gradient of tan = 0, gradient of normal undefined	M1
	$\therefore x = \tan\frac{\pi}{4}$, i.e: $x = 1$	A1 (2)
		(9 marks)
5. (a)	$5 + \lambda = 2 - 3\mu$; $\quad 3 - 2\lambda = -11 - 4\mu$	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)	$\therefore a - 10 = 4 \quad \Rightarrow a = 14$	M1 A1 (2)
(c)	$\cos\theta = \frac{-3+8+10}{\sqrt{9}\sqrt{25+25}}$	M1 A1
	$= \frac{15}{3\times 5\sqrt{2}} \quad = \frac{1}{\sqrt{2}}$	
	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 $x = -\frac{2}{3} \Rightarrow -\frac{25}{3} = \frac{25}{9}C \quad \Rightarrow C = -3$	B1
	cf x^2 $\quad 0 = -3B + C \Rightarrow B = -1$	M1A1 (4)
(b)	$\int_0^{\frac{1}{2}} \frac{2}{(1-x)^2} - \frac{1}{(1-x)} - \frac{3}{(2+3x)} \, dx$	
	$= \left[\frac{2}{1-x} + \ln\lvert 1-x\rvert - \ln\lvert 2+3x\rvert\right]$	M1 A1ft A1ft A1ft
	$= [4 + \ln\frac{1}{2} - \ln 3\frac{1}{2} - (2 - \ln 2)]$	M1
	$= 2 + \ln \frac{\frac{1}{2}\times 2}{3\frac{1}{2}}$	M1
	$= 2 + \ln \frac{2}{7}$	A1 (7)
		(11 marks)
7. (a)	$\frac{du}{dx} = \frac{1}{2} - \frac{1}{2}\cos 4x; = \frac{1}{2} - \frac{1}{2}(1 - 2\sin^2 2x) = \sin^2 2x$	M1 A1; M1 A1 (4)
(b)	$V = \pi \int x \sin^2 2x \, dx$	M1
	$= \pi\left[x\left(\frac{x}{2} - \frac{1}{8}\sin 4x\right) - \int \frac{x}{2} - \frac{1}{8}\sin 4x \, dx\right]_0^{\frac{\pi}{4}}$	M1 A1 A1
	$= \pi\left[\frac{x^2}{2} - \frac{x}{8}\sin 4x - \left(\frac{x^2}{4} + \frac{1}{32}\cos 4x\right)\right]_0^{\frac{\pi}{4}}$	M1 A1
	$= \pi\left[\frac{\pi^2}{64} + \frac{1}{32} + \frac{1}{32}\right] = \pi\left[\frac{\pi^2}{64} + \frac{1}{16}\right]$	M1 A1 (8)
		(12 marks)

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