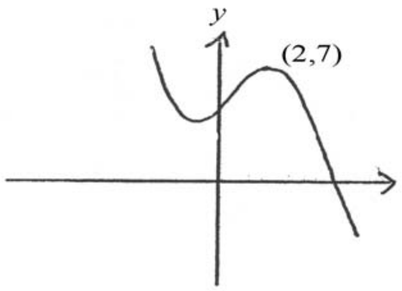
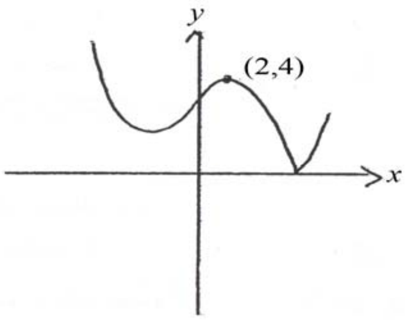
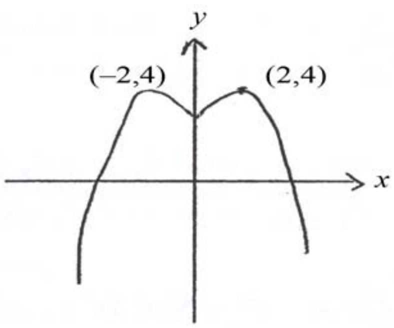
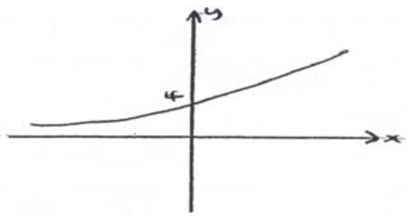
Question Number	Scheme	Marks
1. (a)	$(1+6x)^4 = 1+4(6x)+6(6x)^2+4(6x)^3+(6x)^4$ $= 1+24x+216x^2+864x^3+1296x^4$	M1 A1 A1 (3)
(b)	substitute x=100 to obtain 601^4 = 1 + 2400 + 2160000 + 864000000 + 129600000000 = 130,466,162,401	M1o.e. A1 (2)
2. (a)		B1 Shape B1 Point (2)
(b)		B1 Shape B1 Point (2)
(c)		B1 Shape >0 B1 Shape x<0 B1 Point (-2,4) (3)

3.	$\frac{x(2x+3)}{(2x+3)(x-2)} - \frac{6}{(x-2)(x+1)}$	B1, B1
	$= \frac{x(x+1)-6}{(x-2)(x+1)}$	M1 A1ft
	$= \frac{(x+3)(x-2)}{(x-2)(x+1)}$	M1 A1
	$= \frac{x+3}{x+1}$	A1 (7)
	Alternative 1	
	$\frac{2x^2+3x}{(2x+3)(x-2)} - \frac{6}{(x-2)(x+1)}$	B1
	$= \frac{(2x^2+3x)(x+1)-6(2x+3)}{(2x+3)(x-2)(x+1)}$	M1 A1ft
	$= \frac{(2x^3+5x^2-9x-18)}{(2x+3)(x-2)(x+1)}$	A1
	$= \frac{(x-2)(2x^2+9x+9)}{(2x+3)(x-2)(x+1)}$	M1
	$= \frac{(x-2)(2x+3)(x+3)}{(2x+3)(x-2)(x+1)}$, $= \frac{x+3}{x+1}$	A1, A1
	Alternative 2:	
	$\frac{2x^2+3x}{(2x+3)(x-2)} - \frac{6}{x^2-x-2}$	
	$= \frac{x(2x+3)}{(2x+3)(x-2)} - \frac{6}{x^2-x-2}$	B1
	$= \frac{x(x^2-x-2)-6(x-2)}{(x-2)(x^2-x-2)}$, $= \frac{x^3-x^2-2x-6x+12}{(x-2)(x^2-x-2)}$	M1A1ft
	$= \frac{x^3-x^2-8x+12}{(x-2)(x^2-x-2)}$	A1
	$= \frac{(x-2)(x^2+x-6)}{(x-2)(x^2-x-2)}$	M1
	$= \frac{(x+3)(x-2)}{(x-2)(x+1)}$, $= \frac{x+3}{x+1}$	A1,A1

Question Number	Scheme	Marks
4.	$\frac{dy}{dx}=\frac{1}{x}$	M1 A1
	At x=3, gradient of normal $=\frac{-1}{\frac{1}{3}}=-3$	M1
	$y-\ln 1=-3(x-3)$	M1
	$y=-3x+9$	A1 (5)
5. (a)	$x(2x^2-1)=4$	M1
	$2x^2-1=\frac{4}{x}$	
	$2x^2=\frac{4+x}{x}$	M1
	$x^2=\frac{4+x}{2x}$	
	$x=\sqrt{\frac{2}{x}+\frac{1}{2}}$ **AG**	A1 (3)
	Alternative 1:	
	$2x^2-1-\frac{4}{x}=0$	M1
	$2x^2=1+\frac{4}{x}$	
	$x^2=\frac{1}{2}+\frac{4}{2x}$	M1
	$x\sqrt{\frac{1}{2}+\frac{2}{x}}$ **AG**	A1
	Alternative 2:	
	$x^2=\frac{2}{x}+\frac{1}{2}$	M1
	$2x^3=4+x$	M1
	$2x^2-x-4=0$	A1

(b)	1.41, 1.39, 1.39 (1.40765, 1.38593, 1.393941)	B1,B1,B1 (3)
(c)	$f(1.3915) = -3\times10^{-3}$ $f(1.3925) = 7\times10^{-3}$ change in sign means root between 1.3915 & 1.3925 $\therefore 1.392$ to 3dp	M1 A1 B1 (3)
6. (a)	$-2x+4=\dfrac{3}{2x}$ $4x^2-8x+3=0$ $(2x-3)(2x-1)=0$ $x=0.5, 1.5$	M1 A1 M1 A1 (4)
(b)	$\int_{0.5}^{1.5} -2x+4dx = \left[-x^2+4x\right]_{0.5}^{1.5}$ or $\frac{1}{2}\times(3+1)\times1$ $=2$ $\int_{0.5}^{1.5} \frac{3}{2x}\,dx = \left[\frac{3}{2}\ln x\right]_{0.5}^{1.5}$ $=\frac{3}{2}\ln 3$ $\therefore$ Area $=2-\frac{3}{2}\ln 3$	M1 A1 M1 A1 A1ft A1 (6)
	Alternative solution: Area $=\int_{0.5}^{1.5} -2x+4-\frac{3}{2x}dx$ $=\left[-x^2+4x-\frac{3}{2}\ln x\right]_{0.5}^{1.5}$ $=\frac{-9}{4}+\frac{1}{4}+6-2-\frac{3}{2}\ln 3$ o.e. $=2-\frac{3}{2}\ln 3$	 M1 M1A1A1 A1ft A1

7. (a)	<table><tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>0</td><td>0.062</td><td>0.271</td><td>0.716</td><td>1.612</td><td>3.482</td></tr></table>	B1, B1, B1 (3)
(b)	$1\times\frac{1}{2}\left(0+3.482+2\right)\times\left(0.062+0.271+0.716+1.612\right)$ $=4.402\,\text{m}^2$	B1,M1,A1ft A1 (4)
(c)	$6\times 4.402=26.4\,\text{m}^3$	B1 ft (1)
(d)	trapezium rule overestimates $\therefore$ will be enough	B1B1 (2)
8. (a)	$gf(x)=e^{2(2x+\ln 2)}$ $=e^{4x}e^{2\ln 2}$ $=e^{4x}e^{\ln 4}$ $=4e^{4x}$ AG	M1 M1 M1 A1 (4)
(b)		B1 shape & (0,4) (1)
(c)	$gf\left(x\right)>0$	B1 (1)
(d)	$\frac{d}{dx}gf\left(x\right)=16e^{4x}$ $e^{4x}=\frac{3}{16}$ $4x=\ln\frac{3}{16}$ $x=-0.418$	M1 M1 attempt to solve A1 A1 (4)

9. (a) (i)	$\dfrac{\cos 2x}{\cos x+\sin x} = \dfrac{\cos^2 x-\sin^2 x}{\cos x+\sin x}$	M1
	$= \dfrac{(\cos x+\sin x)(\cos x-\sin x)}{\cos x+\sin x}$	
	$= \cos x-\sin x$ **AG**	A1 (2)
(ii)	$\frac{1}{2}(\cos 2x-\sin 2x) = \frac{1}{2}(2\cos^2 x-1-2\sin x\cos x)$	M1, M1
	$= \cos^2 x-\frac{1}{2}-\sin x\cos x$ AG	A1 (3)
(b)	$\cos\theta\left(\dfrac{\cos 2\theta}{\cos\theta+\sin\theta}\right) = \frac{1}{2}$	
	$\cos\theta(\cos\theta-\sin\theta) = \frac{1}{2}$	M1
	$\cos^2\theta-\cos\theta\sin\theta = \frac{1}{2}$	
	$\frac{1}{2}(\cos 2\theta+1)-\frac{1}{2}\sin 2\theta = \frac{1}{2}$	M1
	$\frac{1}{2}(\cos 2\theta-\sin 2\theta) = 0$	
	$\sin 2\theta = \cos 2\theta$ AG	A1 (3)
(c)	$\sin 2\theta = \cos 2\theta$	
	$\tan 2\theta = 1$	M1
	$2\theta = \frac{\pi}{4}, \frac{5\pi}{4}, \frac{9\pi}{4}, \frac{13\pi}{4}$	A1 for 1
	$\theta = \frac{\pi}{8}, \frac{5\pi}{8}, \frac{9\pi}{8}, \frac{13\pi}{8}$	M1(4 solns) A1 (4)