H1 CA2

Qn	Solutions	
1	$\frac{\mathrm{d}}{\mathrm{d}x}\ln\left(5-6x^2\right)=-\frac{12x}{5-6x^2}$	

Qn	Solutions	
2	From G.C, the numerical value of gradient of *D* at point x = 1 is 2.	
	Equation of tangent at *D* is: $y-0=2\left(x-1\right)$ $y=2x-2$	

Qn	Solutions	
3(a)	$\int\frac{\left(3x^2-1\right)^2}{x}\,\mathrm{d}x$ $=\int\frac{9x^4-6x^2+1}{x}\,\mathrm{d}x$ $=\int 9x^3-6x+\frac{1}{x}\,\mathrm{d}x$ $=\frac{9}{4}x^4-3x^2+\ln x+c$	
3(b)	$\int\frac{1}{2\sqrt{1-\pi x}}\,\mathrm{d}x$ $=\frac{1}{2}\int\left(1-\pi x\right)^{-\frac{1}{2}}\,\mathrm{d}x$ $=\frac{1}{2}\frac{\left(1-\pi x\right)^{\frac{1}{2}}}{\frac{1}{2}\left(-\pi\right)}+c$ $=\frac{\left(1-\pi x\right)^{\frac{1}{2}}}{-\pi}+c$	

Qn	Solutions	
4	$R=\int_0^2 \mathrm{e}^{1-\frac{1}{2}x}+3x\,\mathrm{d}x$ $=\left[\frac{\mathrm{e}^{1-\frac{1}{2}x}}{-\frac{1}{2}}+\frac{3x^2}{2}\right]_0^2$ $=\left[\frac{\mathrm{e}^{1-\frac{1}{2}(2)}}{-\frac{1}{2}}+\frac{3(2)^2}{2}\right]-\left[\frac{\mathrm{e}^{1-\frac{1}{2}(0)}}{-\frac{1}{2}}+\frac{3(0)^2}{2}\right]$ $=4+2\mathrm{e}$ $p=4, q=\mathrm{e}$ Since $\mathrm{e}^{1-\frac{1}{2}x}=m-3x$ has no real roots, $m<1.2494$ $m<1.25$ (to 3 s.f.)	

Qn	Solutions	
5(i)	Curve surface area = $\pi r\times\frac{4\pi}{r^2}=\frac{4\pi^2}{r}$ Area of rectangle = $2r\times\frac{4\pi}{r^2}=\frac{8\pi}{r}$ Total surface area of the trash bin = $\frac{8\pi}{r}+\frac{4\pi^2}{r}+\frac{1}{2}\pi r^2$	
(ii)	$A=\frac{8\pi}{r}+\frac{4\pi^2}{r}+\frac{1}{2}\pi r^2$ $\frac{\mathrm{d}A}{\mathrm{d}r}=-\frac{8\pi}{r^2}-\frac{4\pi^2}{r^2}+\pi r$ To minimize surface area of the trash bin, $\frac{\mathrm{d}A}{\mathrm{d}r}=0$ $-\frac{8\pi}{r^2}-\frac{4\pi^2}{r^2}+\pi r=0$ $8\pi+4\pi^2=\pi r^3$ $r^3=4\pi+8$	
	[Hence] Ratio of diameter of semi-circular surface to height of the trash bin $=2r:\frac{4\pi}{r^2}$ $=r^3:2\pi$ $=4\pi+8:2\pi$ $=2\pi+4:\pi$	

Qn	Solution	
6(i)	$C=(35)(500)+(0.95)(5)x-30e^{0.01x}$ $\therefore C=17500+4.75x-30e^{0.01x}$	
6(ii)	$\frac{dC}{dx}=4.75-30(0.01)e^{0.01x}$ $=4.75-0.3e^{0.01x}$ For maximum or minimum, $\frac{dC}{dx}=0$. $4.75-0.3e^{0.01x}=0$ $x=276.212$ When $x=276.212$, C = \$18337.01.	
	Using 1st derivative test, x: 276.10, 276.212, 276.23 $\frac{dC}{dx}$: 0.0053045, 0, -0.004194 Slope: /, -, \ OR Using 2nd derivative test, $\frac{d^2C}{dx^2}=-0.003e^{0.01x}<0$ (since $e^{0.01x}>0$) Hence maximum C.	

x	276.10	276.212	276.23
$\frac{dC}{dx}$	0.0053045	0	-0.004194
Slope	/	-	\