Question Number	Scheme	Notes	Marks
2.	$y=\sqrt{9-x^2},\ 0\le x\le 3$		
(a)	$\dfrac{\mathrm{d}y}{\mathrm{d}x}=-\dfrac{x}{\sqrt{9-x^2}}$	Correct derivative in any form.	B1
	Note that the derivative may be obtained implicitly after squaring e.g. $y=\sqrt{9-x^2}\Rightarrow y^2=9-x^2\Rightarrow 2y\dfrac{\mathrm{d}y}{\mathrm{d}x}=-2x\Rightarrow \dfrac{\mathrm{d}y}{\mathrm{d}x}=-\dfrac{x}{\sqrt{9-x^2}}$		
	Length of $C=\displaystyle\int\sqrt{1+\frac{x^2}{9-x^2}}\ \mathrm{d}x$	Uses $\displaystyle\int\sqrt{1+\left(\frac{\mathrm{d}y}{\mathrm{d}x}\right)^2}\ \mathrm{d}x$ with their $\dfrac{\mathrm{d}y}{\mathrm{d}x}$	M1
	Note that the above may be obtained via the implicit route as e.g. $\displaystyle\int\sqrt{1+\left(\frac{\mathrm{d}y}{\mathrm{d}x}\right)^2}\ \mathrm{d}x=\int\sqrt{1+\frac{x^2}{y^2}}\ \mathrm{d}x=\int\sqrt{1+\frac{x^2}{9-x^2}}\ \mathrm{d}x$ In which case the B1 is implied.		
	$=\displaystyle\int\sqrt{\frac{9}{9-x^2}}\,\mathrm{d}x=3\arcsin\frac{x}{3}(+c)\ \left(\text{or } -3\arccos\frac{x}{3}(+c)\right)$ $\displaystyle\int_0^3\sqrt{\frac{9}{9-x^2}}\,\mathrm{d}x=3\arcsin(1)-3\arcsin(0)\ \left(\text{or } -3\arccos(1)+3\arccos(0)\right)$ Finds common denominator, integrates to obtain arcsin… or arccos… and applies the limits 0 and 3.		M1
	$=\dfrac{3\pi}{2}*$	Obtains the printed answer with no errors. This mark should be withheld if there is no evidence at all of the limits being applied.	A1
	Special case: If $+\dfrac{x}{\sqrt{9-x^2}}$ is obtained for $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ score B0M1M1A1 if otherwise correct but allow full recovery in (b)		
			(4)
(b)	Surface Area $=\displaystyle\int 2\pi\sqrt{9-x^2}\left(\sqrt{\frac{9}{9-x^2}}\right)\mathrm{d}x$	Uses $\displaystyle\int 2\pi y\sqrt{1+\left(\frac{\mathrm{d}y}{\mathrm{d}x}\right)^2}\ \mathrm{d}x$ with their $\dfrac{\mathrm{d}y}{\mathrm{d}x}$	M1
	$=\displaystyle\int_0^3 6\pi\,\mathrm{d}x=6\pi\left[x\right]_0^3=\ldots$	Integrates to obtain kx and applies the limits 0 and 3. Condone omission of the lower limit.	M1
	$=18\pi$	18π cao	A1
			(3)
			Total 7