Question Number	Scheme	Marks
3a)	$\int_0^9$	B1
	$V=(\pi)\int_0^9\left(3-\sqrt{x}\right)^2\,\mathrm{d}x$	M1
	$V=(\pi)\int_0^9\left(9-6\sqrt{x}+x\right)\mathrm{d}x$	
	$V=(\pi)\left[9x-4x^{\frac{3}{2}}+\frac{x^2}{2}\right]_0^9$	A1
	$V=(\pi)\left[81-108+\frac{81}{2}\right]\quad\left(-\pi[0]\right)$	
	$V=\frac{27}{2}\pi$ *	A1*
		(4)
3b)	$(\pi)\int xy^2\mathrm{d}x=(\pi)\int\left(9x-6x^{\frac{3}{2}}+x^2\right)\mathrm{d}x$	M1
	$=(\pi)\left[\frac{9}{2}x^2-\frac{12}{5}x^{\frac{5}{2}}+\frac{x^3}{3}\right]_0^9$	A1
	$=(\pi)\left(\left[\frac{729}{2}-\frac{2916}{5}+\frac{729}{3}\right]-[0]\right)$	
	$=\frac{243}{10}(\pi)$	A1
	$\overline{x}=\frac{(\pi)\int xy^2\mathrm{d}x}{(\pi)\int y^2\mathrm{d}x}$	DM1
	$\overline{x}=\frac{\left(\frac{243}{10}\right)}{\left(\frac{27}{2}\right)}=1.8$	A1 **(5)**
		[9]

(a)		
B1	Identifying correct limits.	
M1	Attempt at $(\pi)\int_0^9\left(3-\sqrt{x}\right)^2\,\mathrm{d}x$. π not needed. Limits may be missing. Minimum accepted for the squaring is $9\pm k\sqrt{x}\pm x$. At least one term must be integrated (power increased) and none to be differentiated (power decreased)	
A1	Correct integration. π not needed but (correct) limits now needed.	
A1*	**Given** result reached from fully correct working. π must not just appear on final line without justification (as this is a "show that" question).	
(b)		
M1	$(\pi)\int xy^2\mathrm{d}x=(\pi)\int\left(9x-6x^{\frac{3}{2}}+x^2\right)\mathrm{d}x$. π not needed.	
A1	Correct integration. π not needed.	
A1	Correct result from substitution of correct upper limit. (Lower limit is 0 and substitution of 0 gives 0)	
DM1	Use of $\overline{x}=\dfrac{(\pi)\int xy^2\mathrm{d}x}{(\pi)\int y^2\mathrm{d}x}$. π must appear in both or neither. Depend on both previous M marks	
A1	1.8. Accept any exact equivalent eg $\dfrac{18}{10},\dfrac{9}{5},1\dfrac{4}{5}$ etc.	