Question	Scheme	Marks	AOs
8(a)	$(0.4,\ 4) \Rightarrow 0.4 = k \times 4^2 + \sqrt{4} \Rightarrow k = ...$	M1	3.3
	$k = -0.1$	A1	1.1b
		(2)	
(b)	Cylinder volume = $\pi \times 0.4^2 \times 0.5 = 0.08\ \pi = \frac{2}{25}\pi$	B1	3.4
	Volume generated by curve = $\pi \int x^2\, dy$ $\pi \int \left(\sqrt{y} + ky^2\right)^2 \{dy\} = \pi \int \left(\sqrt{y} - 0.1y^2\right)^2 \{dy\}$	M1	3.1b
	$= \{\pi\} \int \left(y + 2ky^{\frac{5}{2}} + k^2 y^4\right) \{dy\}$ $= \{\pi\} \int \left(y - 0.2y^{\frac{5}{2}} + 0.01y^4\right) \{dy\}$	A1ft	1.1b
	$= \{\pi\} \int_0 \left(y - 0.2y^{\frac{5}{2}} + 0.01y^4\right) \{dy\}$ $\Rightarrow \{\pi\} \left[Ay^2 + By^{\frac{7}{2}} + Cy^5 \right]$ at least one of their terms with the correct power	M1	3.4
	$= \{\pi\} \left[\frac{y^2}{2} + \frac{4k}{7} y^{\frac{7}{2}} + \frac{k^2}{5} y^5 \right]$ $= \{\pi\} \left[\frac{y^2}{2} - \frac{2}{35} y^{\frac{7}{2}} + \frac{1}{500} y^5 \right]$	A1ft	1.1b
	$V = \pi \left(8 - \frac{256}{35} + \frac{256}{125}\right) - (0) + \frac{2}{25}\pi$ $V = \frac{2392}{875}\pi + \frac{2}{25}\pi$	M1	3.4
	$V = \frac{2462\pi}{875} \text{cm}^3$	A1	2.2b
		(7)	
(c)	E.g. • The equation of the curve may not be a suitable model • The sides of the ornament will not be perfectly smooth • There may be flaws/bubbles within the glass • The corner (ABC) may not be a perfect right angle	B1	3.5b
		(1)	

(d)	Makes an appropriate comment that is consistent with their value for the volume and 9 cm^3. Some evidence of making a comparison and draws a conclusion E.g. a good estimate as 8.84 cm^3 is only 0.16 cm^3 less than 9 cm^3 • A volume between 8.5 and 9.5 is a good model • A volume between 8 and 10 can be either a good or bad model • A volume less than 8 or more than 10 is a bad model, over estimate or underestimate • model volume is less, not enough glass would be ordered so it is a bad model, following a correct answer to (b)	B1ft	3.5a
		(1)	
			(11 marks)

Notes

(a)

M1: Substitutes (0.4, 4) into the equation modelling the curve in an attempt to find the value of k

A1: Infers from the data in the model, the value of k

(b)

B1: Uses the information given in the model to establish the correct volume of the cylinder

M1: Uses the model and applies $\pi\int x^2\{dy\}$, dy not required and π may appear later in their solution. If they find an expression for x^2 first and then substitutes into the formula score M1 even if an incorrect expansion.

A1ft: Correct expression for the volume generated by the curve with the bracket expanded (follow through their k value), dy not required and π may appear later in their solution. Indices need to be processed for this mark, may be seen later in the solution.

M1: Attempts to integrate with at least one power raised by 1

A1ft: Correct integration (follow through on their expression for x^2 as long as there are 3 terms). Need not be simplified.

M1: Uses the correct limits and finds the sum of the 2 volumes. Must come from an attempt at $\pi\int_0^4 x^2\{dy\}$ and an attempt at the volume of the cylinder, condone incorrect formula used as long as it is 3 dimensional not an area.

A1: $\frac{2462\pi}{875}$

Use of calculator scores a maximum of B1M1A0M0A0M1A0 volume = π2.7337…

(c)

B1: States an acceptable limitation of the model, which is the curve but accept flaws/bubbles in the glass. Measurements may not be accurate, or anything related to thickness is B0

(d)

B1ft: Compares the actual volume to their answer to part (b) and makes an assessment of the model with a reason. If using a percentage error then they must use 9 as the true volume.