Question	Scheme	Marks	AOs
7(a)	Depth = 0.16 (m)	B1	2.2b
		(1)	
(b)	$y=1+kx^2 \Rightarrow 1.16=1+k(0.2)^2 \Rightarrow k=...$	M1	3.3
	$\Rightarrow k=4$ cao $\left\{\text{So } y=1+4x^2\right\}$	A1	1.1b
		(2)	
(c)	$\frac{\pi}{4}\int(y-1)\,\mathrm{d}y$ $\frac{\pi}{4}\int y\,\mathrm{d}y$	B1ft	1.1a
	$=\left\{\frac{\pi}{4}\right\}\int_1^{1.16}(y-1)\,\mathrm{d}y$ $=\left\{\frac{\pi}{4}\right\}\int_0^{0.16}y\,\mathrm{d}y$	M1	3.3
	$=\left\{\frac{\pi}{4}\right\}\left[\frac{y^2}{2}-y\right]_1^{1.16}$ $=\left\{\frac{\pi}{4}\right\}\left[\frac{y^2}{2}\right]_0^{0.16}$	M1 A1	1.1b 1.1b
	$=\frac{\pi}{4}\left(\left(\frac{1.16^2}{2}-1.16\right)-\left(\frac{1}{2}-1\right)\right)\ \{=0.0032\pi\}$ $=\frac{\pi}{4}\left(\left(\frac{0.16^2}{2}\right)-(0)\right)\ \{=0.0032\pi\}$		
	$V_{\text{cylinder}}=\pi(0.2)^2(1.16)\ \{=0.0464\pi\}$	B1	1.1b
	$\text{Volume}=0.0464\pi-0.0032\pi\ \{=0.0432\pi\}$	M1	3.4
	$=0.1357168026...=0.136\,(\text{m}^3)\ (3\text{sf})$	A1	1.1b
		(7)	
(d)	Any one of e.g. the measurements may not be accurate the inside surface of the bowl may not be smooth there may be wastage of concrete when making the bird bath	B1	3.5b
		(1)	
(e)	Some comment consistent with their values. We do need a reason e.g. $\left[\left(\frac{0.136-0.127}{0.127}\right)\times 100=7.0866...\right]$ so not a good estimate because the volume of concrete needed to make the bird bath is approximately 7% lower than that predicted by the model **or** We might expect the actual amount of concrete to exceed that which the model predicts due to wastage, so the model does not look suitable since it predicts more concrete than was used	B1ft	3.5a
		(1)	
			(12 marks)

Question 7 notes:
(a) **B1:** Infers that the maximum depth of the bird bath could be 0.16 (m)
(b) **M1:** Substitutes $y = 1.16$ and $x = 0.2$ or $x = -0.2$ into $y = 1 + kx^2$ and rearranges to give $k = ...$ **A1:** $k = 4$ cao
(c) **B1ft:** Uses the model to obtain either $\frac{\pi}{(\text{their } k)}\int (y-1)\,\mathrm{d}y$ **or** $\frac{\pi}{(\text{their } k)}\int y\,\mathrm{d}y$ **M1:** Chooses limits that are appropriate to their model **M1:** Integrates y (with respect to y) to give $\pm\lambda y^2$, where $\lambda \neq 0$ is a constant **A1:** Uses their model correctly to give either $y - 1 \rightarrow \frac{y^2}{2} - y$ or $y \rightarrow \frac{y^2}{2}$ **B1:** $V_{\text{cylinder}} = \pi(0.2)^2(1.16)$ or 0.0464π **or** $\frac{29}{625}\pi$, o.e. **M1:** Depends on **both** previous M marks Uses the model to find $V_{\text{their cylinder}}$ – their integrated volume **A1:** 0.136 cao
(d) **B1:** States an acceptable limitation of the model
(e) **B1ft:** Compares the actual volume with their answer to (c). Makes an assessment of the model. E.g. evaluates the percentage error and uses this to make a sensible comment about the model with a reason