② Correction

$$V = \int_1^2 2\pi r h \, dx$$

$$= \int_1^2 2\pi \left(x - \tfrac{1}{2}\right) \log_2 x \, dx$$

$$= \int_1^2 2\pi x \log_2 x \, dx + \int_1^2 2\pi \left(-\tfrac{1}{2}\right) \log_2 x \, dx$$

$$= 4\pi - \frac{3\pi}{2\ln 2} \quad * \quad \pi \int_1^2 \log_2 x \, dx$$

$$= 4\pi - \frac{3\pi}{2\ln 2} \quad * \quad \pi \left[x \log_2 x - \frac{x}{\ln 2} \right]_1^2$$

$$\int \log_2 x \, dx = x \log_2 x - \frac{1}{\ln 2} \int 1 \, dx$$

$u = \log_2 x \quad dv = dx$

$du = \frac{1}{\ln 2 \, x} \quad v = x$

$$= x \log_2 x - \frac{x}{\ln 2} + C$$

$$= 4\pi - \frac{3\pi}{2\ln 2} \quad * \quad -\pi \left[\left(2 \cdot 1 - \frac{2}{\ln 2}\right) - \left(0 - \frac{1}{\ln 2}\right) \right]$$

$$= 4\pi - \frac{3\pi}{2\ln 2} \quad * \quad \pi \left[2 * \frac{1}{\ln 2} \right]$$

$$= 2\pi - \frac{\pi}{2\ln 2}$$