Quindi:

$$V(E) = 2\int_0^{2\pi} d\theta \int_0^{\rho(\theta)} \sqrt{4+\rho^2}\,\rho\, d\rho =$$

$$= \int_0^{2\pi} \left[\frac{2}{3}\sqrt{(4+\rho^2)^3} \right]_0^{\rho(\theta)} d\theta =$$

$$= \frac{2}{3}\int_0^{2\pi} \left[(4+\rho^2(\theta))^{3/2} - 4 \right] d\theta =$$

$$= \frac{2}{3}\cdot 4^{3/2} \int_0^{2\pi} \left[(1+|\cos\theta|)^{3/2} - 1 \right] d\theta =$$

$$= \frac{2}{3}\cdot 4^{3/2} \left\{ 2\int_{\pi/2}^{\frac{3}{2}\pi} (1-\cos\theta)^{3/2}\, d\theta - 2\pi \right\} =$$

$$= \frac{8}{3}\sqrt{2} \left\{ \int_{\pi/2}^{\frac{3}{2}\pi} \left(2\,\mathrm{sen}^2 \frac{\theta}{2}\right)^{3/2} d\theta - \pi \right\} \overset{t=\frac{\theta}{2}}{=}$$

$$= \frac{8}{3}\sqrt{2} \left\{ 4\sqrt{2} \int_{\pi/4}^{\frac{3}{4}\pi} \underbrace{|\mathrm{sen}\, t|^3}_{=\mathrm{sen}^3 t}\, dt - \pi \right\} \overset{s=\cos t}{=}$$

$$= \frac{8}{3}\sqrt{2} \left\{ 4\sqrt{2} \int_{-\frac{1}{\sqrt{2}}}^{\frac{1}{\sqrt{2}}} (1-s^2)\, ds - \pi \right\}$$

$$= \frac{8}{3}\sqrt{2} \left\{ 4\sqrt{2} \left(\sqrt{2} - \frac{\cancel{2}^{\,1}}{3}\,\frac{1}{\cancel{2}_{\,1}\sqrt{2}} \right) - \pi \right\} =$$

$$= \frac{8}{3}\sqrt{2} \left(\frac{20}{3} - \pi \right)$$