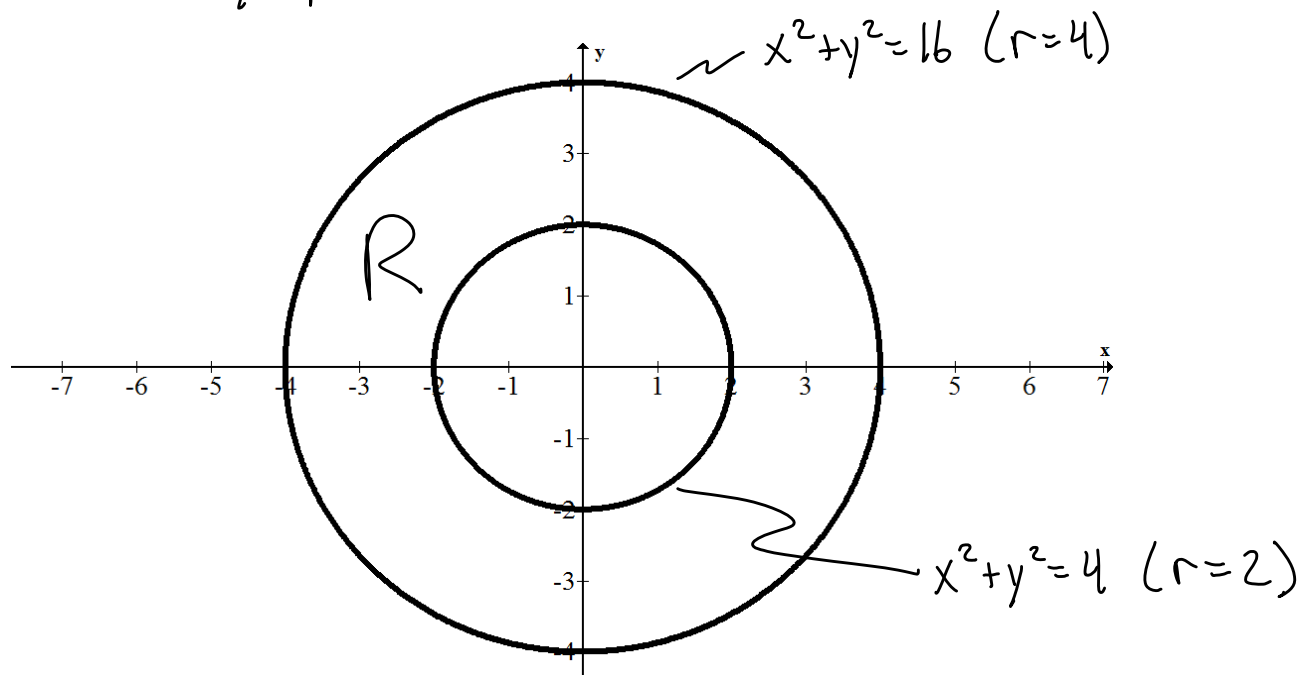


### 14.3 #10

We can use symmetry and double the volume that is above the  $xy$ -plane.



$$\text{Volume} = 2 \iint_R \sqrt{16 - x^2 - y^2} \, dA$$

$$= 2 \int_0^{2\pi} \int_2^4 \sqrt{16-r^2} \, r \, dr \, d\theta$$

$$u = 16 - r^2 \quad du = -2r \, dr$$

$$r=4 \Rightarrow u=0, \quad r=2 \Rightarrow u=12$$

$$= 2 \int_0^{2\pi} \left[ -\frac{1}{2} \int_{12}^0 \sqrt{u} \, du \right] d\theta = \int_0^{2\pi} \int_0^{12} u^{\frac{1}{2}} \, du \, d\theta$$

$$= \int_0^{2\pi} \left. \frac{2}{3} u^{\frac{3}{2}} \right|_0^{12} d\theta = \int_0^{2\pi} \frac{2}{3} (12\sqrt{12}) \, d\theta$$

$$= 2\pi \left( \frac{2}{3} \right) (12\sqrt{12}) = 32\pi\sqrt{3}$$