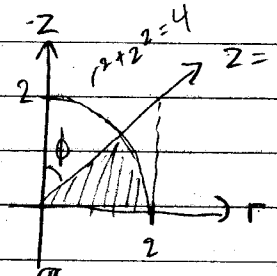
WH Q1

$f = x^2 + y^2 + z^2$

$\theta \in [0, 2\pi]$



$r^2 + z^2 = 4$

$\phi = \frac{\pi}{4}$

$\phi \in [\frac{\pi}{4}, \frac{\pi}{2}]$

$\rho \in [0, 2]$

$$\int_0^{2\pi} \int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \int_0^2 \rho^2 \cdot \rho^2 \sin\phi \, d\rho \, d\phi \, d\theta$$

$$= \int_0^{2\pi} \int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \sin\phi \cdot \frac{2^5}{5} \, d\phi \, d\theta$$

$$= \frac{32}{5} \int_0^{2\pi} \theta - \left(-\frac{\sqrt{2}}{2}\right) d\theta$$

$$= \frac{32\sqrt{2} \cdot 2\pi}{10}$$

$$= \frac{32\sqrt{2}\pi}{5}$$