

$$2. \vec{F}(x, y, z) = (\partial x) \vec{i} + (\partial y) \vec{j} + (\partial z) \vec{k}$$

$$S: x^2 + y^2 + z^2 = 4$$

$$\operatorname{div} \vec{F} = \partial + \partial + \partial = 6$$



$$\iiint 6$$

$$= \int_{\theta=0}^{\theta=2\pi} \int_{\phi=0}^{\phi=\pi} \int_{\rho=0}^{\rho=2} 6 \rho^2 \sin \phi \, d\rho \, d\phi \, d\theta$$

$$= 6 \int_{\theta=0}^{\theta=2\pi} \int_{\phi=0}^{\phi=\pi} \left[\frac{1}{3} \rho^3 \sin \phi \right]_{\rho=0}^{\rho=2} d\phi \, d\theta$$

$$= 6 \cdot \frac{1}{3} \int_{\theta=0}^{\theta=2\pi} \int_{\phi=0}^{\phi=\pi} (2^3 \sin \phi) \, d\phi \, d\theta$$

$$= 6 \cdot \frac{1}{3} \cdot 8 \int_{\theta=0}^{\theta=2\pi} \left[-\cos \phi \right]_{\phi=0}^{\phi=\pi} d\theta$$

$$= -16 \int_{\theta=0}^{\theta=2\pi} [\cos \pi - \cos 0] \, d\theta$$

$$= -16 \int_{\theta=0}^{\theta=2\pi} (-1 - 1) \, d\theta$$

$$= -16(-2) \left[\theta \right]_{\theta=0}^{\theta=2\pi}$$

$$= 32 [2\pi - 0]$$

$$= \boxed{64\pi}$$