Subtract!

- **sphere**

$$\int_0^{2\pi}\int_0^{\pi}\int_0^{\sqrt{2}} r^2\sin^2\theta\, r^2\sin\theta\, dr\,d\theta\,d\phi$$

$$= 2\pi\frac{r^5}{5}\Big|_0^{\sqrt{2}} \int_0^{\pi}(1-\cos^2\theta)\sin\theta\, d\theta$$

$$= \frac{2\pi\sqrt{32}}{5}\left(-\cos\theta + \frac{\cos^3\theta}{3}\right)_0^{\pi} = \frac{8\pi}{15}\sqrt{32} = \frac{32\pi}{15}\sqrt{2}$$

- **cylinder**

$$\int_{-1}^{1}\int_0^{2\pi}\int_0^{1} r^2\, r\, dr\,d\theta\,dz = 2\pi\cdot\frac{r^4}{4}\Big|_0^1 \cdot z\Big|_{-1}^1 = \pi$$

- **2 caps**

$$2\int_1^{\sqrt{2}}\int_0^{2\pi}\int_0^{\sqrt{2-z^2}} r^2\, r\, dr\,d\theta\,dz$$

$$= 4\pi\int_1^{\sqrt{2}} \frac{r^4}{4}\Big|_0^{\sqrt{2-z^2}}\, dz$$

$$= \pi\int_1^{\sqrt{2}} (2-z^2)^2\, dz$$

$$= \pi\left(4z - \frac{4z^3}{3} + \frac{z^5}{5}\right)_1^{\sqrt{2}} = \pi\left(\frac{32\sqrt{2}}{15} - \frac{43}{15}\right)$$

$$\therefore \quad \frac{32\pi}{15}\sqrt{2} - \pi - \frac{32\pi\sqrt{2}}{15} + \frac{43\pi}{15} = \boxed{\frac{28\pi}{15}}$$