

1. (cylindrical coordinates) Sketch the region in rz -space associated with the region of integration in the integral below and describe the shape of the region.

$$\int_0^{\pi/2} \int_0^1 \int_z^{\sqrt{8-z^2}} z^2 r \, dr \, dz \, d\theta.$$

2. (spherical coordinates) Sketch the rz cross-section associated with the region of integration in the integral below and describe the shape of the 3D region.

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

3. Let p be the joint probability density function such that $p(x, y) = \frac{1}{4}x$ in the rectangle R where $0 \leq x \leq 2, 0 \leq y \leq 2$. $p(x, y) = 0$ outside of the rectangle. Set up an integral for the probability that (x, y) satisfies $x + y \leq 1$.