1. Compute $\iiint_E xy \, dV$, where $E$ is the solid in the first octant bounded by the coordinate planes and the surfaces $z = 1 - x^2$ and $y = 1 - x$.
   • (a) We have $\int_0^1 \int_0^{1-x} \int_0^{1-x^2} xy \, dz \, dy \, dx = \frac{1}{30}$.

2. Evaluate $\iiint_E xyz e^z \, dV$, where $E = \{(x, y, z) : 0 \leq z \leq 4 - x^2, 0 \leq y \leq 6, 0 \leq x \leq 2\}$.
   • (c) Similarly, $\int_0^2 \int_0^6 \int_0^{4-x^2} xyz e^z \, dz \, dy \, dx = 18e^4 + 54$.

3. Let $f(x, y, z) = 2\sqrt{4 - x^2 - y^2 - z^2}$. Find $\iiint_E f(x, y, z) \, dV$, where $E$ is the solid spherical ball of radius 2 centered at the origin.
   • (e) Use spherical coordinates: $\int_0^{2\pi} \int_0^\pi \int_0^2 2\sqrt{4 - \rho^2} \rho^2 \sin \phi \, d\rho \, d\phi \, d\theta = 8\pi^2$.

4. Find the mass of the solid $E$ in the first octant bounded by the cone $z = \sqrt{x^2 + y^2}$, the circular cylinder $x^2 + y^2 = 4$, and the coordinate planes. Its variable density is $\delta = \frac{e^{x^2+y^2}}{\sqrt{x^2 + y^2}}$.
   • (c) Use cylindrical coordinates: $\int_0^{\pi/2} \int_0^2 \int_0^r r e^r \, dz \, dr \, d\theta = \int_0^{\pi/2} \int_0^2 \int_0^r e^r \, dz \, dr \, d\theta = \frac{1}{7\pi} (e^4 - 1)$. 