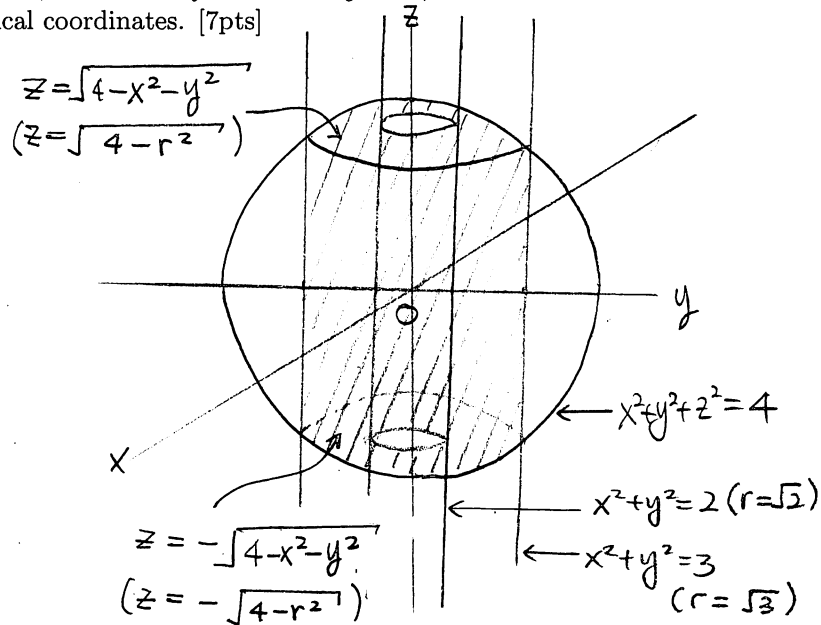


Instructions. The point value of each problem is indicated in square brackets. To obtain full credit, you must have the correct answers along with relevant supporting work to justify them. Partial credit will be given based on the work that is shown. However, **answers without supporting work will receive no credit.**

Problem 1. Set up (but do **not** evaluate) a triple integral that represents the volume of the solid region that lies outside of the cylinder $x^2 + y^2 = 2$, inside the cylinder $x^2 + y^2 = 3$, and within the sphere $x^2 + y^2 + z^2 = 4$ in terms of cylindrical coordinates. [7pts]

$$\int_0^{2\pi} \int_{\sqrt{2}}^{\sqrt{3}} \int_{-\sqrt{4-r^2}}^{\sqrt{4-r^2}} r \, dz \, dr \, d\theta$$



Problem 2. Set up (but do **not** evaluate) a triple integral that represents the volume of the solid region that lies within the cone $z = -\sqrt{x^2 + y^2}$ and the sphere $x^2 + y^2 + z^2 = 4$ in terms of spherical coordinates. [8pts]

$$\int_{\frac{3\pi}{4}}^{\pi} \int_0^{\pi} \int_0^2 \rho^2 \sin \phi \, d\rho \, d\theta \, d\phi$$

