1(a) Suppose we want to find the point on the surface $xy^2z^3 = 2$ that is closest to the origin. Write down a system of equations whose solution will include this closest point. [Do not solve the system or proceed any further.]

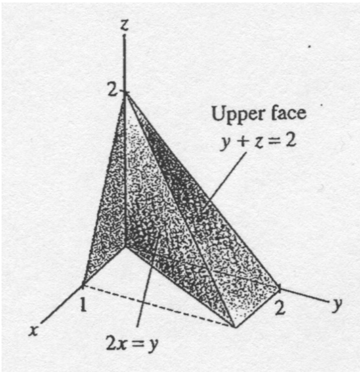
2(a) Use polar coordinates to combine the sum

$$\int_0^1 \int_{\sqrt{1-x^2}}^{\sqrt{4-x^2}} xy\,dy\,dx \;+\; \int_1^2 \int_0^{\sqrt{4-x^2}} xy\,dy\,dx$$

into *one* double integral. Do not evaluate the integral. [Draw the region!]

(b) Sketch the region, and evaluate theintegral $\int_0^1 \int_{x^2}^1 x^3 \sin(y^3)\,dy\,dx$ by reversing the order of integration.

3. The figure below shows the region E bounded by $y + z = 2$, $2x = y$, $x = 0$, and $z = 0$. Express $\iiint_E xe^z\, dV$ in three ways, using $dV = dzdxdy$, $dV = dydzdx$, and $dV = dxdydz$.



4(a) Express the integral $\iiint_E y\,dV$ in spherical coordinates, where E is the region $x^2 + y^2 + z^2 \leq 1$, $x, y, z \leq 0$.

(b) Sketch the solid whose volume is given by the integral $\int_0^4 \int_0^{2\pi} \int_r^4 r\,dz d\theta dr$, and evaluate this integral.