0. Calculate \( \int \int_R x \, dA \) where \( R \) is the triangular region with vertices \((0,0), (0,2), (1,0)\).

\[
\int_0^1 \int_{1-x}^{2-2x} x \, dy \, dx = \int_0^1 x \left[ \frac{2(1-x)}{1-x} \right]_1^0 = \int_0^1 x \cdot (1-x) \, dx = \int_0^1 x - x^2 \, dx = \left[ \frac{1}{2} x^2 - \frac{1}{3} x^3 \right]_0^1 = \frac{1}{6}
\]

2. Switch the order of integration and compute \( \int_0^1 \int_{y/3}^{1} \sqrt{1 + x^3} \, dx \, dy \)

\[
= \int_0^1 \int_0^{y/3} (1 + x^3)^{1/2} \, dx \, dy = \int_0^1 \left( \frac{2}{3} \right) (1 + x^3)^{3/2} \, dy = \left[ \frac{1}{2} \frac{2^{3/2}}{3} (1 + x^3)^{3/2} \right]_0^1 = \left| \frac{1}{6} \left( 2^{3/2} - \frac{1}{6} \right) \right|
\]
3. Switch to polar coordinates and compute \[ \int_0^1 \int_0^{\sqrt{2-y^2}} \int_0^{\sqrt{y^2-x^2}} r^3 \, dx \, dy \, dz. \]

\[ = \int_0^{\pi/4} \int_0^1 r^3 \, dr \, d\theta \]

\[ = \int_0^{\pi/4} 1 \, d\theta = \left[ \frac{\pi}{4} \right] \]

4. \( \) Set up iterated triple integrals, with appropriate limits, for finding the volumes of the solid regions \( E \) below. DO NOT EVALUATE.

5. \( E \) is the solid region bounded by the planes: \( x = 0 \), \( z = 0 \), \( x - y + z = 1 \), and \( 2x + y + 2z = 2 \).

\[ \int_0^1 \int_0^{1-x} \int_0^{2-2x-2z} 1 \, dz \, dx \, dy \]

6. \( E \) is the solid region that lies outside the cylinder \( x^2 + y^2 = 4 \), below the paraboloid \( z = 9 - x^2 - y^2 \), and above the \( xy \)-plane.

\[ \int_0^{\pi} \int_0^3 \int_0^{\sqrt{9-r^2}} r \, dz \, dr \, d\theta \]
5. Compute $\iiint_E z \, dV$, where $E$ is the region in the first octant that lies outside (below) the cone $z = \sqrt{x^2 + y^2}$ and inside the sphere $x^2 + y^2 + z^2 = 4$.

\[
\begin{align*}
\iiint_E z \, dV &= \int_0^{\pi/2} \int_0^{\pi/2} \int_0^1 \rho^2 \sin \phi \rho \cos \phi \, d\rho \, d\phi \, d\theta \\
&= \int_0^{\pi/2} \int_0^{\pi/2} \left( \frac{1}{4} \rho^4 \right) \cos \phi \sin \phi \, d\phi \, d\theta \\
&= \int_0^{\pi/2} \frac{1}{4} \sin \phi \cos \phi \, d\phi \, d\theta = \int_0^{\pi/2} 2 \sin^2 \phi \, d\phi \\
&= \int_0^{\pi/2} 2 \left( 1 - \cos 2\phi \right) \, d\phi = \int_0^{\pi/2} 1 \, d\theta = \frac{\pi}{2}
\end{align*}
\]

6. Let $C$ be the straight line segment from $(1, 0, 2)$ to $(-1, 2, 1)$.

Compute:

5. $\oint_C x \, dy = \int_0^1 (1 - 2t)(2) \, dt$

\[
\begin{align*}
\oint_C x \, dy &= \int_0^1 (1 - 2t)(2) \, dt \\
&= 2t - 2t^2 \bigg|_0^1 = 0
\end{align*}
\]

7. $\oint_C y \, ds = \int_0^1 2t \sqrt{(-2)^2 + (2t)^2 + (-1)^2} \, dt$

\[
\begin{align*}
\oint_C y \, ds &= \int_0^1 2t \sqrt{4 + 4t^2 + 1} \, dt \\
&= \int_0^1 2t \cdot 3 \, dt = 3t^2 \bigg|_0^1 = 3
\end{align*}
\]