(1) Calculate the volume of the region bounded by the four planes \( x = 2 \), \( y = 3 \), \( z = 0 \), and \( x - y - z + 3 = 0 \) by setting up an integral in the order \( dy \, dx \, dz \).

\[
\int_0^2 \int_z^2 \int_3^{x-z+3} 1 \, dy \, dx \, dz = \int_0^2 \int_z^2 \left( \frac{[y]^3}{3} - (x - z + 3) \right) \, dx \, dz \\
= \int_0^2 \int_z^2 (x - z) \, dx \, dz \\
= \int_0^2 \left( \frac{x^2}{2} - xz \right) \bigg|_z^2 \, dz \\
= \int_0^2 \left( 2 - 2z - \frac{z^2}{2} - z^2 \right) \, dz \\
= \left[ 2z - z^2 + \frac{z^3}{6} \right]_0^2 \\
= 4 - 4 + \frac{8}{6} \\
= \frac{4}{3}
\]

(2) Evaluate the line integral of \( \vec{F}(x, y, z) = x^2 \vec{i} - xy \vec{j} + \vec{k} \) along the circle of radius 1, center at the origin and lying in the \( yz \) plane.

The circle of radius 1 with center at the origin and lying in the \( yz \) plane is parametrized by \( \vec{r}(t) = \langle 0, \cos t, \sin t \rangle \) with \( 0 \leq t \leq 2\pi \). The line integral is

\[
\int_0^{2\pi} \langle 0, 0, 1 \rangle \cdot \langle 0, -\sin t, \cos t \rangle \, dt = \int_0^{2\pi} \cos t \, dt = \sin t \bigg|_0^{2\pi} = 0 - 0 = 0.
\]

(Extra-credit) Show that if a particle is moved along a closed curve (that is, \( \vec{r}(a) = \vec{r}(b) \)), then the work done on it by the vector field

\[
\vec{F}(x, y, z) = -\frac{1}{(x^2 + y^2 + z^2)^{3/2}}(x \vec{i} + y \vec{j} + z \vec{k})
\]

is zero.

We have done this in class. It is because \( \vec{F}(x, y, z) \) is the gradient of

\[
f(x, y, z) = \frac{1}{(x^2 + y^2 + z^2)^{1/2}}.
\]