Problem 1. (4 points) Find the surface area of the part of the paraboloid 
\[ z = x^2 + y^2 \] which lies inside of the cylinder \( x^2 + y^2 = 1 \).

\[ S = \iint_D \sqrt{1 + (2x)^2 + (2y)^2} \, dA \]
\[ = \int_0^{2\pi} \int_0^1 \sqrt{1 + 4r^2 \cos^2 \theta + 4r^2 \sin^2 \theta} \, r \, dr \, d\theta \]
\[ = \int_0^{2\pi} \int_0^1 \sqrt{1 + 4r^2} \, r \, dr \, d\theta \]
\[ = 2\pi \cdot \frac{1}{8} \cdot \frac{2}{3} (5^{3/2} - 1) = \frac{\pi}{6} (5^{3/2} - 1) \]

Problem 2. (2 points each part) Write the triple integral \( \iiint_E xyz \, dV \) as an iterated integral, where:

A) \( E \) lies under the plane \( x + y + z = 2 \) and above the region in the \( xy \)-plane which is bounded by \( y = -x^2 + 2, \ x = 0 \) and \( y = 0 \).
B) \( E \) is the region in the first octant which is above the plane \( z = 0 \), below the cone \( z = \sqrt{x^2 + y^2} \) and inside the sphere \( x^2 + y^2 + z^2 = 1 \).

*Hint: use spherical coordinates (because it involves a sphere).*

\[
\iiint (p \sin \varphi \cos \theta)(p \sin \varphi \sin \theta)(p \cos \varphi) p^2 \sin \varphi \, dp \, d\varphi \, d\theta
\]

C) \( E \) is the region to the right of the \( xz \)-plane (nonnegative \( y \)) which is below the paraboloid \( z = x^2 + y^2 \), inside the cylinder \( x^2 + y^2 = 1 \) and above the plane \( z = 0 \).

*Hint: use cylindrical coordinates (because the projection onto the \( xy \)-plane is convenient to describe in polar coordinates).*

\[
\iiint (r \cos \varphi \cdot (r \sin \varphi) z \, r \, dr \, d\theta
\]