(1) [10 pts] Use polar coordinates to find the volume of the solid bound between the surfaces \( z = x^2 + y^2 \) and \( z = (2\pi)^2 \).

\[
V = \int_0^{2\pi} \int_0^{2\pi} \int_0^{(2\pi)^2 - (r^2)} r \, dr \, d\theta \, dz
\]

\[
= \int_0^{2\pi} \int_0^{2\pi} \left[ (2\pi)^2 r - \frac{1}{3} r^3 \right]_0^{2\pi} \, d\theta
\]

\[
= \frac{32}{3} \pi^4
\]