You have 10 minutes to complete the quiz. Calculators are not permitted, and remember to show your calculations and explain your reasoning in order to receive full credit.

1. Evaluate \( \iiint_E xe^{x^2+y^2+z^2} \, dV \) where \( E \) is the portion of the unit ball \( x^2 + y^2 + z^2 \leq 1 \) lying in the first octant \( (x, y, z \geq 0) \).

   The unit ball constraint gives the bounds \( 0 \leq \rho \leq 1 \) and constraining the domain to the first octant is equivalent to the bounds \( 0 \leq \theta, \phi \leq \pi/2 \). As \( x^2 + y^2 + z^2 = \rho^2 \) and \( x = \rho \sin \phi \cos \theta \), the integral becomes

   \[
   \iiint_E xe^{x^2+y^2+z^2} \, dV = \int_{\rho=0}^{1} \int_{\theta=0}^{\pi/2} \int_{\phi=0}^{\pi/2} (\rho \sin \phi \cos \theta)e^{\rho^2} \rho^2 \sin \phi \, d\phi \, d\theta \, d\rho
   \]

   \[
   = \left( \int_{\rho=0}^{1} \rho^3 e^{\rho^2} \, d\rho \right) \left( \int_{\theta=0}^{\pi/2} \cos \theta \, d\theta \right) \left( \int_{\phi=0}^{\pi/2} \sin^2 \phi \, d\phi \right)
   \]

   \[
   = \left( \left[ \frac{1}{2} \rho^2 e^{\rho^2} \right]_0^1 - \frac{1}{2} \left[ e^{\rho^2} \right]_0^1 \right) \left( [\sin \theta]_0^{\pi/2} \right) \left( \left[ \frac{\theta}{2} - \sin(2\theta) \right]_0^{\pi/2} \right)
   \]

   \[
   = \left( \frac{1}{2} \right) \left( 1 \right) \left( \frac{\pi}{4} \right)
   \]

   \[
   = \frac{\pi}{8}.
   \]