1. The electric field at any point \( p(x,y,z) \) due to a point charge \( q \) at the origin is given by

\[
\vec{E}(x,y,z) = \frac{1}{4\pi\varepsilon_0} q \frac{\left( \hat{x} + y\hat{y} + z\hat{z} \right)}{\left( x^2 + y^2 + z^2 \right)^{3/2}}.
\]

Compute the total electrical flux through a spherical Gaussian surface using two methods described below as (a) and (b). The spherical Gaussian surface is centered at the origin and has a radius of \( r = 3 \), which is bigger than the dimensions of the point charge. This means that the charge is enclosed by the Gaussian surface.

a. Evaluate \( \Phi = \oint \vec{E} \cdot \hat{n} \, ds = ? \)

b. Evaluate \( \Phi = \iiint (\nabla \cdot \vec{E}) \, dV = ? \) (you must evaluate the divergence, before you evaluate the integral.)

c. If your answers are different, write a comment to reconcile them.

\[\text{Note that } \vec{E} \text{ is the electric field due to a point charge at the origin.}\]

\[\text{According to Gauss's law.}\]

\[\text{The correct answer is (a). You cannot use (b), because } \vec{E} \text{ is not differentiable at the origin.}\]