1. (10pts) Using the geodesic equation, show that a "great circle" on a unit sphere of in $\mathbb{R}^3$, i.e. $x^\mu (\lambda) = (1, \lambda, \phi_0)$ is not a geodesic. You may use any results from your homework without deriving them again.
2. (10pts) An infinite uniformly charge wire sits in $\mathbb{R}^3$. In cylindrical coordinates $(z, \rho, \phi)$ where $z$ is the axis of the cylinder, the metric takes the form $g_{\mu\nu} = \text{diag}(1, 1, \rho^2)$ and the only nonzero Christoffel symbols are $\Gamma^\rho_{\phi\phi} = -\rho$ and $\Gamma^\phi_{\rho\phi} = \Gamma^\phi_{\phi\rho} = \frac{1}{\rho}$. The electric field generated by the wire takes the form $\vec{E}(z, \rho, \phi) = \frac{\lambda}{2\pi\varepsilon_0} \frac{\rho}{\rho^2}$. Compute the directional derivative of the electric field along the curve $x^\mu(\lambda) = (\lambda^2, 2, \pi)$.