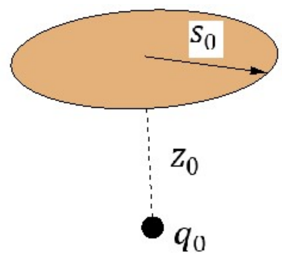
Q1. Find the electric flux through a disc of radius s_0 located a distance z_0 from a point charge q_0. See the figure. Use two methods to find the answer

A- symmetry argument [hint: the solid angle subtended by the disc is $\int_{\phi=0}^{2\pi}\int_{\theta=0}^{\theta_0}\sin\theta\, d\theta d\phi = 2\pi(1-\cos\theta_0) = 2\pi\left(1-\frac{z_0}{\sqrt{s_0^2+z_0^2}}\right)$], and

B- direct calculation using $\phi_E = \int_S \vec{E}\cdot d\vec{a}$



Q2. Find the electric field at any point in the x-y plane due to a straight-line segment of length $2\,L$ and linear charge density λ. The segment is located along the x-axis with its midpoint at the origin.

Q3. Use Mathematica to show on the same plot the segment and a stream plot of the electric field in the range $-3 \le x \le 3$ and $-3 \le y \le 3$. Use $L = 1$ and $\lambda = 4\pi\epsilon_0$.

Note: the stream plot is not the same as the field lines plot. The stream plot gives the direction of the electric field but its line density is not proportional to the strength of the electric field.