

1 Electric Field of a Point Charge from the Potential

(2, 2, 2 pts)

The electrostatic potential due to a point charge at the origin is given by:

$$V = \frac{1}{4\pi\epsilon_0} \frac{q}{r}$$

- (a) Find the electric field due to a point charge at the origin as a gradient in rectangular coordinates.
- (b) Find the electric field due to a point charge at the origin as a gradient in spherical coordinates.
- (c) Find the electric field due to a point charge at the origin as a gradient in cylindrical coordinates.

2 Electric Field of a Line Source From Potential

(4 pts)

Find the electric field around an infinite, uniformly charged, straight wire, starting from the following expression for the electrostatic potential:

$$V(\vec{r}) = \frac{2\lambda}{4\pi\epsilon_0} \ln\left(\frac{s_0}{s}\right)$$

3 Line Sources Using Coulomb's Law

(4, 4 pts)

- (a) Find the electric field around a finite, uniformly charged, straight rod, at a point a distance s straight out from the midpoint, starting from Coulomb's Law.
- (b) Find the electric field around an infinite, uniformly charged, straight rod, starting from the result for a finite rod.