Wednesday Reading Assessment: Unit 1, Electric Fields

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February 5, 2020

1 Electric Fields

1. Consider Fig. 1 below. A ring of charge with radius R is situated in the xy-plane. The charge is positive, and it is distributed evenly across the ring. We write $dq = \lambda R d\theta$, to mean that there is λ Coulombs per unit length. If $d\theta$ were to extend to 2π (all the way around the circle), then the total charge is $Q = \lambda(2\pi R)$. (a) By symmetry, where should the electric field be zero? (b) Where would the electric field be infinite?

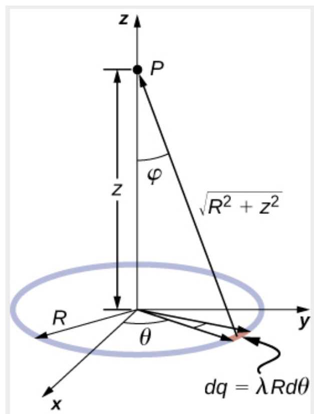

Figure 1: THings.

2. Consider again Fig. 1. As $z \to \infty$, what happens to the field?
   - A: The field-strength increases.
   - B: The field-strength remains constant.
   - C: The field-strength decreases.
   - D: The field-strength is exactly zero.

3. Suppose the actual function for the E-field $\vec{E}(z)$ is

$$\vec{E}(z) = \frac{1}{4\pi\epsilon_0}\frac{qz}{\left(z^2+R^2\right)^{3/2}}\hat{z} \quad (1)$$

   Evaluate the following limit:

$$\lim_{z\to\infty}\vec{E}(z) = \lim_{z\to\infty}\frac{1}{4\pi\epsilon_0}\frac{qz}{\left(z^2+R^2\right)^{3/2}}\hat{z} \quad (2)$$

   (Hint: it's not just zero. Think about what the field should be if we observe it from far away).