10/9/13
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Solution to Problem 10.5

Recall 10.3

$$\left.\begin{array}{l} * V(\vec{r},t) = 0 \\ * \vec{A}(\vec{r},t) = -\frac{1}{4\pi\epsilon_0}\frac{qt}{r^2}\hat{r} \end{array}\right\} \rightarrow \left\{\begin{array}{l} \vec{E}(\vec{r},t) = -\vec{\nabla}V - \dot{\vec{A}} = \frac{q}{4\pi\epsilon_0}\frac{\hat{r}}{r^2} \\ \vec{B}(\vec{r},t) = \vec{\nabla}\times\vec{A} = 0 \end{array}\right\}$$

* NB this is a stationary point charge at the origin!

Transformed Potentials with $\Lambda = -\frac{qt}{4\pi\epsilon_0 r}$

$$* V'(\vec{r},t) = V - \frac{\partial\Lambda}{\partial t} = \frac{q}{4\pi\epsilon_0 r}$$

$$* \vec{A}'(\vec{r},t) = \vec{A} + \vec{\nabla}\Lambda = -\frac{1}{4\pi\epsilon_0}\frac{qt}{r^2}\hat{r} + \frac{1}{4\pi\epsilon_0}\frac{qt}{r^2}\hat{r} = 0$$

* NB this is the very same physical system but it looks more conventional in this gauge
* NB the apparent time dependence of $\vec{A}(\vec{r},t)$ was a "gauge artifact"