Set 10, Due: Wednesday: 25th November

1. An alternate way of calculating the Green-functions, $G^\pm$ is to Fourier analyse with respect to both $\vec{r}$ and $t$:

$$-\Box^2 G(\vec{r}, t) = \delta^3(\vec{r}) \delta(t)$$

and let

$$G(\vec{r}, t) = \int \frac{d^3k}{(2\pi)^3} \frac{d\omega}{(2\pi)} e^{i\vec{k}.\vec{r}} e^{-i\omega t} G(\vec{k}, \omega)$$

Show

$$G(\vec{k}, \omega) = \frac{1}{k^2 - \frac{\omega^2}{c^2}}$$

2. Consider a particle traveling in a straight line:

$$\vec{r}(t) = \vec{r}_0 + \vec{v}_0 t$$

Calculate $t_{\text{ret}}$ for a single single point charge as a function of $r$ and $t$

$$t_{\text{ret}} = t_{\text{ret}}(\vec{r}, t)$$

where

$$t_{\text{ret}} = t - \frac{|\vec{r} - \vec{r}(t_{\text{ret}})|}{c}$$

3. Show asymptotically (for large $|\vec{r}|$) that

$$\vec{E} \simeq -\hat{r} \times \vec{B}$$