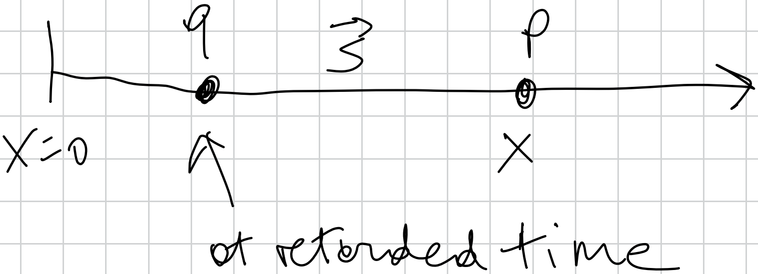
SESSION 7

(a)



$$\vec{E} = \frac{q}{4\pi\varepsilon_0} \frac{s}{(\vec{s}\cdot\vec{u})^3} \left[(c^2 - v^2)\vec{u} + \vec{s} \times (\vec{u} \times \vec{a}) \right]$$

$$\vec{v} = v\hat{x} \qquad a = a\hat{x} \qquad \hat{s} = \hat{x}$$

$$\vec{u} = (c - v)\hat{x} \qquad \vec{u} \times \vec{a} = 0 \qquad \vec{s}\cdot\vec{u} = s(c - v)$$

$$\vec{E} = \frac{q}{4\pi\varepsilon_0} \frac{s}{s^3 (c-v)^3} (c^2 - v^2)(c - v)\,\hat{x}$$

And since $c^2 - v^2 = (c+v)(c-v)$

$$\boxed{\vec{E} = \frac{q}{4\pi\varepsilon_0}\frac{1}{s^2}\left(\frac{c+v}{c-v}\right)\hat{x}}$$

$$\vec{B} = \frac{1}{c}\hat{s}\times\vec{E} = \frac{1}{c}\hat{x}\times\vec{E} \qquad \boxed{\vec{B}=0}$$

To the left now:

Same as before except that

$\hat{s} = -\hat{x}$ so $\vec{u} = -(c+v)\hat{x}$

and $\vec{s}\cdot\vec{u} = s(c+v)$.

This then gives

$$\vec{E} = -\frac{q}{4\pi\varepsilon_0}\frac{s}{s^3(c+v)^3}(c^2-v^2)((c+v)\hat{x}$$

$$\boxed{\vec{E} = -\frac{q}{4\pi\varepsilon_0}\frac{1}{s^2}\left(\frac{c-v}{c+v}\right)\hat{x}}$$

As before, $\boxed{\vec{B}=0}$ from the cross product.

(b) In equation 10.75 $\vec{R}$ is is at time t. In part (a) s is at time t_R

Since $R = s - v(t - t_R)$

$$R = s - v\left(t - t + s/c\right)$$

$$R = s\left(1 - v/c\right)$$

or $s = R/(1 - v/c)$

It is then simple algebra to show that the two are equivalent