Magnitude of $\underline{E}$ in S

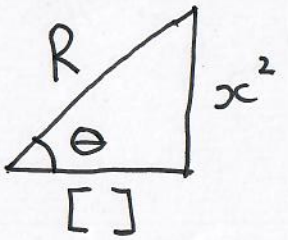
Given symmetry around $\hat{x}'$ let's consider $\underline{E}$ in the $x'-x^2$ plane

$$|\underline{E}| = \left(E_1^2 + E_2\right)^{1/2}$$

$$= \frac{q\gamma}{4\pi\epsilon_0}\left(\frac{[\,]^2 + (x^2)^2}{\left\{\gamma^2[\,]^2 + (x^2)^2\right\}^3}\right)^{1/2}$$

$$[\,] = [x' - \beta x^0]$$

uses (15.3) (15.4)



$$R^2 = [\,]^2 + (x^2)^2$$

$$\sin\theta = x^2/R, \quad \cos\theta = [\,]/R$$

$$|E| = \frac{q\gamma}{4\pi\epsilon_0}\frac{1}{R^2}\left(\frac{1}{\gamma^2\left(1-\sin^2\theta\right)+\sin^2\theta}\right)^{3/2}$$

$$\because \frac{1}{\gamma^2} = 1-\beta^2$$

$$= \frac{q}{4\pi\epsilon_0}\frac{1}{R^2}\frac{1}{\gamma^2}\left(\frac{1}{1-\beta^2\sin^2\theta}\right)^{3/2}$$

Exercise: Verify these steps.

(15.7)