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a. (5 pts.) The total charge on the rod is Q. What is β?

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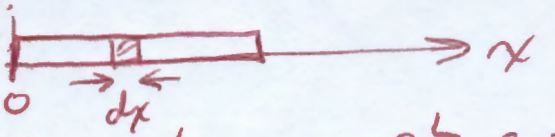

a. $Q = \int_0^L \lambda\, dx = \int_0^L \beta x^2 dx = \frac{1}{3}\beta L^3 \Rightarrow \boxed{\beta = \frac{3Q}{L^3}}$

b. $E = \int_0^L \frac{1}{4\pi\epsilon_0}\frac{dq}{x^2} = \int_0^L \frac{1}{4\pi\epsilon_0}\frac{\lambda\, dx}{x^2} = \frac{1}{4\pi\epsilon_0}\int_0^L \frac{\beta x^2 dx}{x^2}$

$E = \frac{1}{4\pi\epsilon_0}\int_0^L \beta\, dx = \frac{1}{4\pi\epsilon_0}\beta L = \frac{1}{4\pi\epsilon_0}\frac{3Q}{L^3}L = \boxed{\frac{1}{4\pi\epsilon_0}\frac{3Q}{L^2}}$