

Problem 1.2

a)

$$\begin{aligned}Q &= \int dQ \\&= \int \lambda(\theta) dl \\&= \int_0^\pi \lambda_0 \cos \theta R d\theta \\&= 0\end{aligned}$$

b)

$$\begin{aligned}dE_x &= \frac{1}{4\pi\epsilon_0} \frac{dQ}{R^2} \cos \theta \\&= \frac{1}{4\pi\epsilon_0} \frac{\lambda_0 \cos \theta R d\theta}{R^2} \cos \theta \\&= \frac{\lambda_0}{4\pi\epsilon_0 R} \cos^2 \theta d\theta \\dE_y &= \frac{\lambda_0}{4\pi\epsilon_0 R} \cos \theta \sin \theta d\theta \\ \vec{E} &= \frac{\lambda_0}{4\pi\epsilon_0 R} \left(\int_0^\pi \cos^2 \theta d\theta \hat{i} + \int_0^\pi \cos \theta \sin \theta d\theta \hat{j} \right) \\&= \frac{\lambda_0}{4\pi\epsilon_0 R} \left(\frac{\pi}{2} \hat{i} + 0 \hat{j} \right) \\&= \frac{\lambda_0}{8\epsilon_0 R} \hat{i}\end{aligned}$$