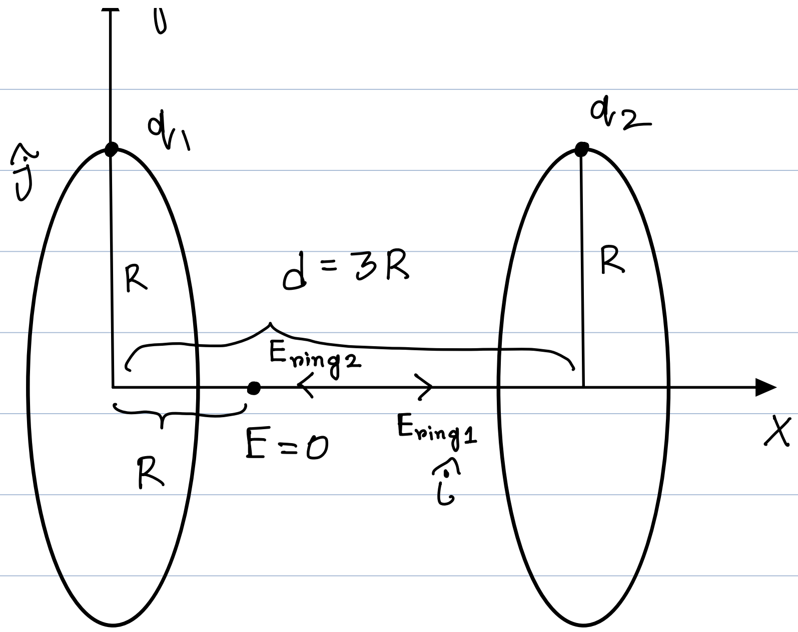
231



$$E = \frac{qz}{4\pi\epsilon_0 (z^2 + R^2)^{3/2}}$$

$$\vec{E}_{ring1} = \frac{qR}{4\pi\epsilon_0 (R^2 + R^2)^{3/2}} \hat{i}$$

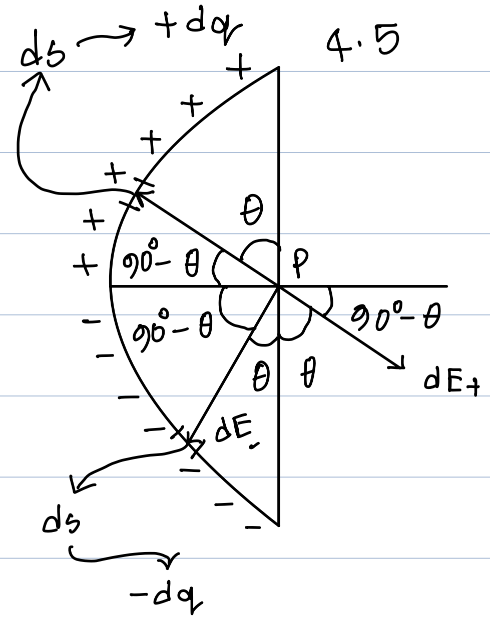
$$\vec{E}_{ring2} = \frac{q \cdot 2R}{4\pi\epsilon_0 ((2R)^2 + R^2)^{3/2}} (-\hat{i})$$

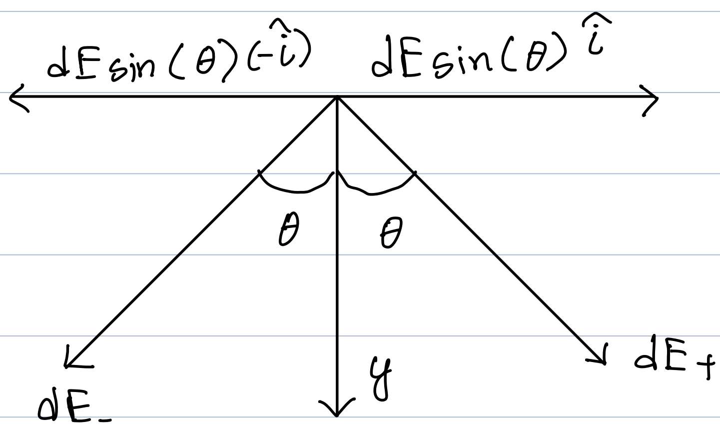
$$\vec{E}_{total} = \vec{E}_{ring1} + \vec{E}_{ring2}$$

$$\Rightarrow \frac{q_1}{(2R^2)^{3/2}} = \frac{2q_2}{(5R^2)^{3/2}}$$

$$\Rightarrow \frac{q_1}{q_2} = \frac{2 \cdot 2^{3/2}}{5^{3/2}}$$

261





$dE\cos(\theta)$

$dE\cos(\theta)$

$$\vec{E} = \int_0^{\pi/2} dE\cos\theta + \int_{-\pi/2}^{0} dE\cos\theta$$

$$= 2\int_{-45^\circ}^{+45^\circ} dE\cos\theta$$

$$\lambda = \frac{q}{\pi R} = \frac{dq}{R\,d\theta}$$

$$dq = \lambda R\,d\theta$$

$$= 2\int_{-45^\circ}^{+45^\circ} \frac{1}{4\pi\varepsilon_0}\frac{dq}{R^2}\cos\theta$$

$$= 2\int_{-45^\circ}^{+45^\circ} \frac{1}{4\pi\epsilon_0} \frac{\lambda R d\theta}{R^2} \cos\theta$$

$$= \frac{2\lambda}{4\pi\epsilon_0 R} \int_{-45^\circ}^{45^\circ} \cos\theta \, d\theta$$

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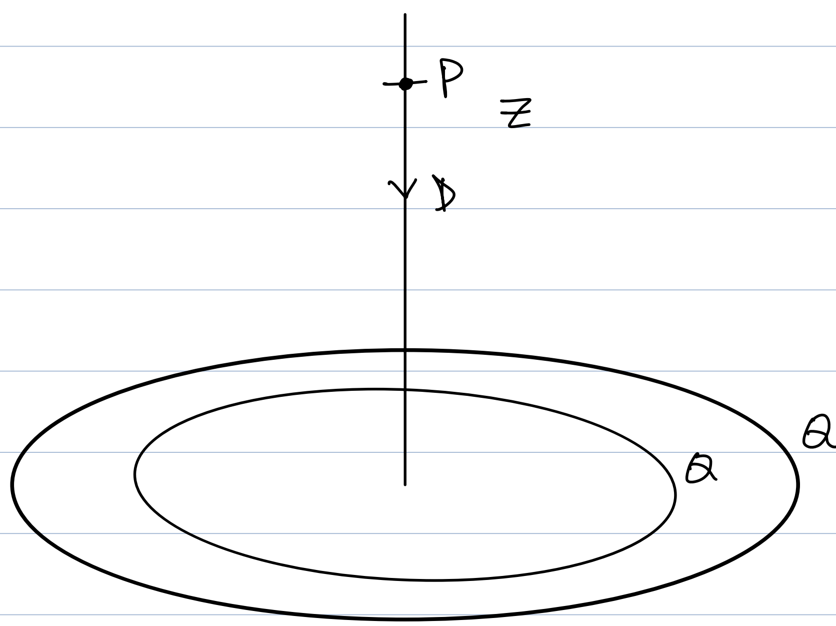
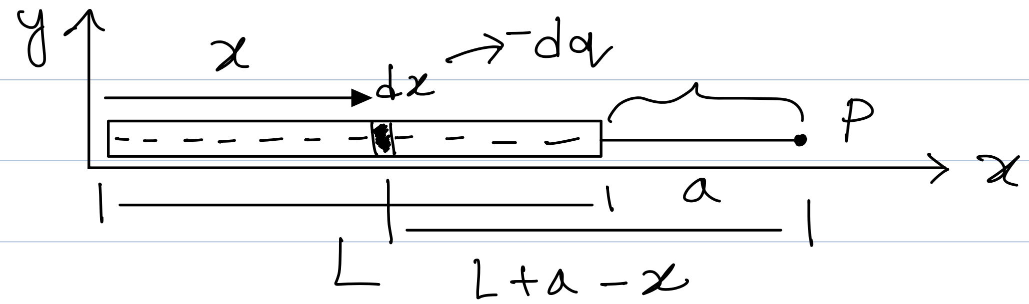


$$E_1 = \frac{q \cdot 2R}{4\pi\epsilon_0 \left((2R)^2 + R^2\right)^{3/2}}$$

$$E_2 = ?$$

31.



$$\overrightarrow{dE} = \frac{1}{4\pi\epsilon_0} \frac{dq}{(L+a-x)^2} (-\hat{i})$$

$$E = \int_0^L \frac{1}{4\pi\epsilon_0} \frac{dq}{(L+a-x)^2} (-\hat{i})$$

$\frac{dq}{dx} = \lambda$

$\Rightarrow dq = \lambda dx$

$$= \int_0^L \frac{1}{4\pi\epsilon_0} \frac{\lambda dx}{(L+a-x)^2} (-\hat{i})$$

$$= \frac{1}{4\pi\epsilon_0} \int_0^L \frac{\lambda dx \; (-\hat{i})}{(L+a-x)^2}$$

$L+a-x = u$

$\Rightarrow dx = -du$

$$= \frac{1}{4\pi\epsilon_0} \int_0^L \frac{\lambda \, du}{u^2} (-\hat{i})$$

$$= \frac{\lambda}{4\pi\epsilon_0} \int_0^L \frac{du}{u^2} (-\hat{i})$$

$$= \left. \frac{\lambda}{4\pi\epsilon_0 u} \right|_0^L (-\hat{i})$$

$$= \left. \frac{\lambda}{4\pi\epsilon_0 (L+a-x)} \right|_0^L (-\hat{i})$$

$$= \frac{\lambda}{4\pi\epsilon_0} \left[\frac{1}{a} - \frac{1}{L+a} \right] (-\hat{i})$$