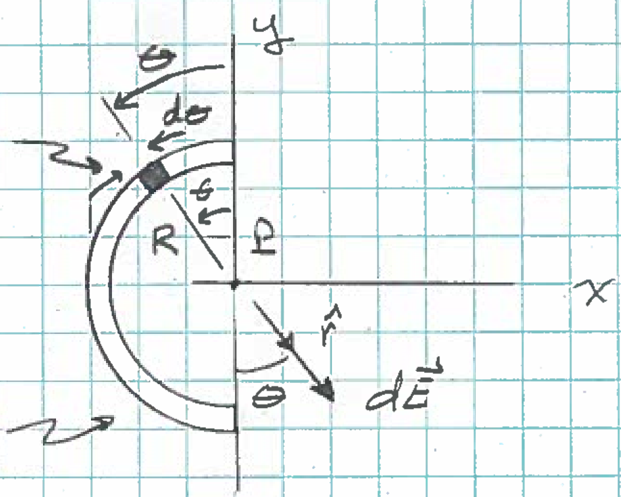
$dq = \lambda ds$
$= \lambda R d\theta$



length L
charge Q
$\lambda = Q/L = \dfrac{Q}{\pi R}$

at P: $\quad d\vec{E} = \dfrac{K\,dq}{r^2}\,\hat{r}$

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

$$r = R$$

$$\hat{r} = \sin\theta\,\hat{i} - \cos\theta\,\hat{j}$$

$$|d\vec{E}| = \frac{K\,dq}{r^2} = \frac{K\lambda R d\theta}{R^2}$$

or, $\quad d\vec{E} = |d\vec{E}|\sin\theta\,\hat{i} - |d\vec{E}|\cos\theta\,\hat{j}$

So:

$$d\vec{E} = \frac{K\lambda R d\theta}{R^2}\left\{\sin\theta\,\hat{i} - \cos\theta\,\hat{j}\right\}$$

By symmetry, the y-comp integrates to zero.

So,

$$dE_x = \frac{K\lambda \sin\theta\, d\theta}{R}$$

and,

$$E_x = \int dE_x = \int_0^{\pi} \frac{K\lambda\sin\theta}{R}\,d\theta = \frac{K\lambda}{R}\int_0^{\pi}\sin\theta\, d\theta$$

So, $\quad E_x = \dfrac{K\lambda}{R}\left(-\cos\theta\right)\Big|_0^{\pi} = -\dfrac{K\lambda}{R}\left\{-1-1\right\}$

$$\therefore \quad E_x = \frac{2K\lambda}{R} = \frac{2K\,Q/L}{L/\pi} = \underline{\frac{2KQ\pi}{L^2}}$$

b.) for $L = 10\,\text{cm}$, $Q = 30\,\text{nC}$ $\qquad \underline{E_x = 1.694 \times 10^5\ \frac{N}{C}}$