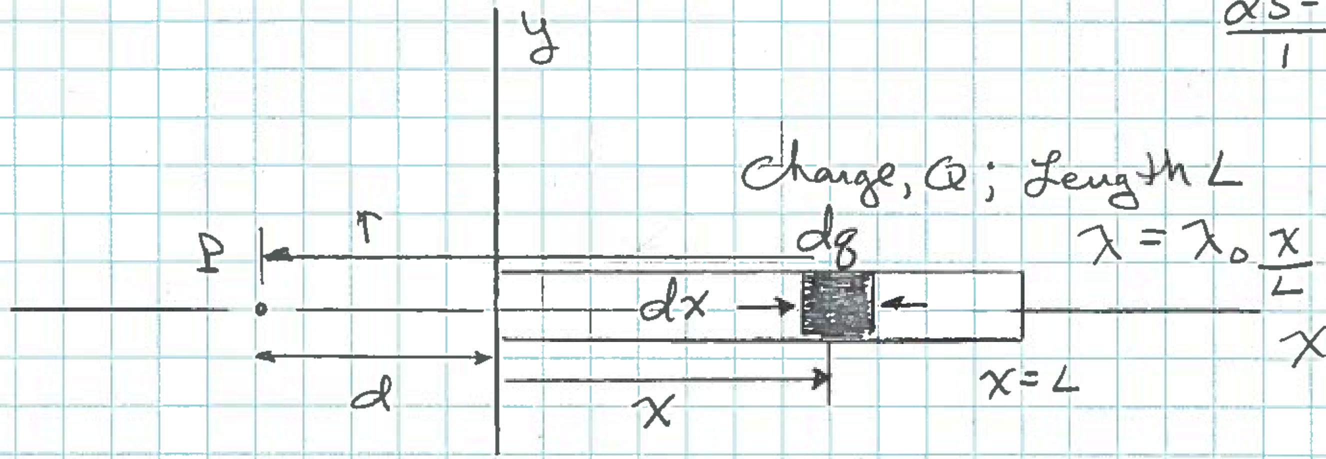

$$dq = \lambda\, dx = \lambda_0 \frac{x}{L}\, dx$$

a.) Total charge, $Q = \int_{Rod} dq = \int_0^L \lambda_0 \frac{x}{L}\, dx$

So,

$$Q = \frac{\lambda_0}{L}\int_0^L x\, dx = \frac{\lambda_0}{L}\left(\frac{x^2}{2}\right)\Big|_0^L = \frac{\lambda_0}{L}\frac{L^2}{2}$$

$$\therefore \quad \lambda_0 = \frac{2Q}{L}$$

b.) dq produces a potential at P:

$$dV = \frac{K\,dq}{r} \qquad dq = \lambda_0 \frac{x}{L}\, dx$$

So: $\qquad r = d + x$

$$dV = \frac{K\lambda_0 \frac{x}{L}\, dx}{(d+x)} = \frac{K\lambda_0}{L}\,\frac{x\, dx}{(d+x)}$$

and

$$V = \int_{Rod} dV = \int_0^L \frac{K\lambda_0}{L}\,\frac{x\, dx}{(d+x)} = \frac{K\lambda_0}{L}\int_0^L \frac{x\, dx}{(d+x)}$$

$$V = \frac{K\lambda_0}{L}\int_0^L \frac{x\,dx}{(d+x)}$$

from Table: $\int \frac{x\,dx}{(a+x)} = x - a\ln(a+x)$

So:

$$V = \frac{K\lambda_0}{L}\left\{x - d\ln(d+x)\right\}\Big|_0^L$$

$$= \frac{K\lambda_0}{L}\left\{\left[L - d\ln(d+L)\right] - \left[-d\ln d\right]\right\}$$

$$= \frac{K\lambda_0}{L}\left\{L + d\left[\ln d - \ln(d+L)\right]\right\}$$

$$= \frac{K\lambda_0}{L}\left\{L + d\ln\left(\frac{d}{d+L}\right)\right\}$$

and $\lambda_0 = \frac{2Q}{L}$

So:

$$V = \frac{2KQ}{L^2}\left\{L + d\ln\left(\frac{d}{d+L}\right)\right\}$$