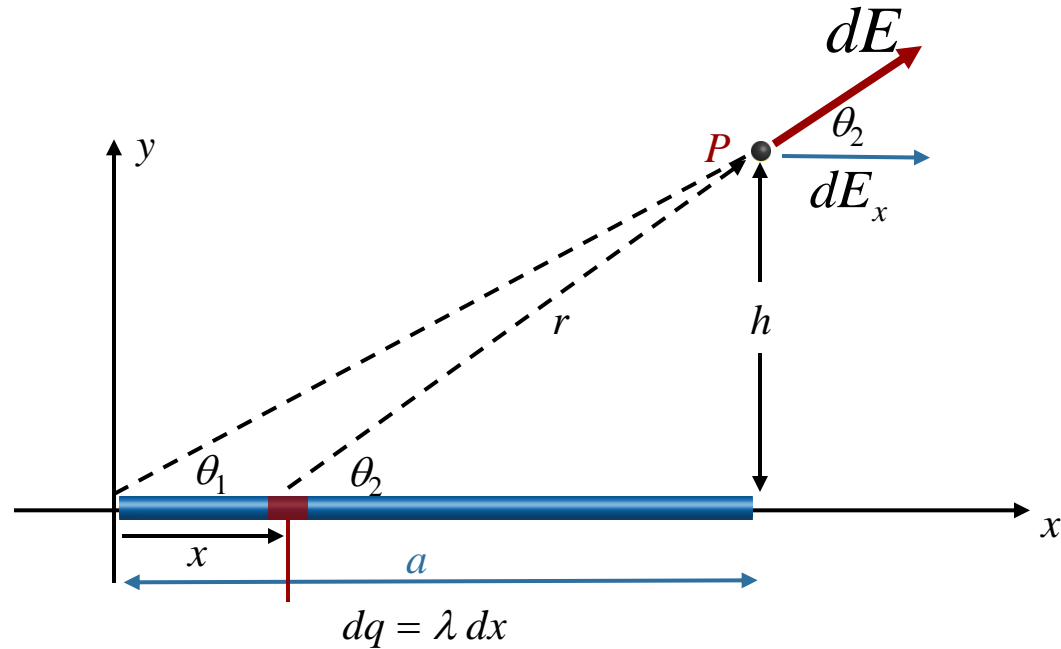# *Calculation*

Charge is uniformly distributed along the *x*-axis from the origin to $x = a$. The charge density is λ C/m. What is the *x*-component of the electric field at point $P: (x,y) = (a,h)$?

$dq = \lambda\, dx$

We know: $\vec{E} = \int k \dfrac{dq}{r^2}\, \hat{r}$

$$\frac{dq}{r^2} = \frac{\lambda dx}{(a-x)^2 + h^2}$$

$$E_x = \int dE \cos\theta_2$$

$$\cos\theta_2 = \frac{a-x}{\sqrt{(a-x)^2 + h^2}}$$

Putting it all together

$$E_x(P) = \lambda k \int_0^a dx \frac{a-x}{\left((a-x)^2 + h^2\right)^{3/2}}$$

$$\longrightarrow \qquad E_x(P) = \frac{\lambda k}{h}\left(1 - \frac{h}{\sqrt{h^2 + a^2}}\right)$$

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