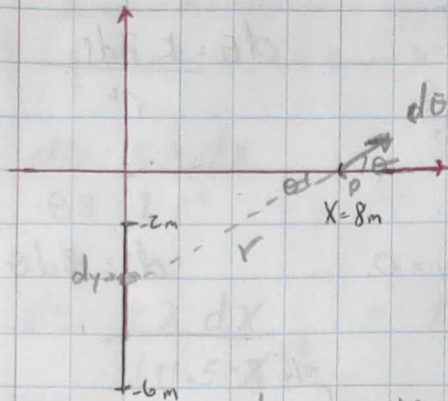


## Problema 1



$$q = 24 \text{ nC}$$

$$dq = \lambda dy$$

$$\lambda = \frac{dq}{dl} = \frac{q}{l} = \frac{24}{4}$$

$$\lambda = 6 \text{ nC/m}$$

$$r = \sqrt{y^2 + 8^2}$$

$$\sin \theta = \frac{-y}{r}$$

$$dE = \frac{k dq}{r^2} \Rightarrow dE_y = dE \sin \theta$$

$$E_y = \int \frac{k \lambda dy}{r^2} = k \lambda \int \frac{dy}{(y^2 + 8^2)^2} \sin \theta = -k \lambda \int_{-6}^{-2} \frac{y dy}{(y^2 + 8^2)^{3/2}}$$

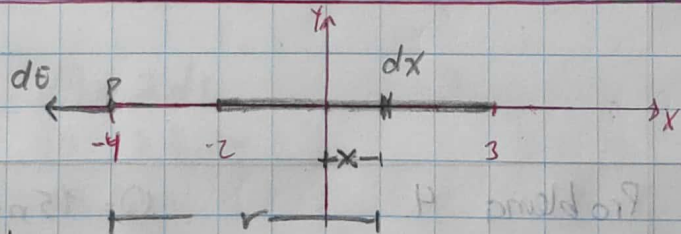
$$E_y = \frac{-k \lambda}{2} \int_{-6}^{-2} \frac{y dy}{(y^2 + 8^2)^{3/2}} \quad u = y^2 + 8^2 \quad du = 2y dy \quad \rightarrow \int \frac{du}{2u^{3/2}} = -\frac{1}{u^{1/2}}$$

$$E_y = -k \lambda \left[ \frac{-1}{(y^2 + 64)^{1/2}} \right]_{-6}^{-2} = k \lambda \left[ \frac{1}{(4 + 64)^{1/2}} - \frac{1}{10} \right] = 1.15 \text{ N/C}$$

$$E_y = 1.15 \text{ N/C}$$

## Problema 2:

$$\lambda = 4 \text{ nC/m}$$



$$dE = \frac{k dq}{r^2}$$

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

$$r = 4 + x$$

$$dq = \lambda dx$$

$$\Rightarrow dE_x = \frac{k \lambda dx}{(4+x)^2}$$

$$E_x = k \lambda \int_{-4}^3 \frac{dx}{(4+x)^2} = -k \lambda \left[ \frac{1}{4+x} \right]_{-4}^3$$

$$E_x = -k \lambda \left[ \frac{1}{4+3} - \frac{1}{4-2} \right] = -k \lambda \left[ \frac{1}{7} - \frac{1}{2} \right] = 12.9 \text{ N/C (to the right)}$$

$$E_x = 12.9 \text{ N/C (to the right)}$$

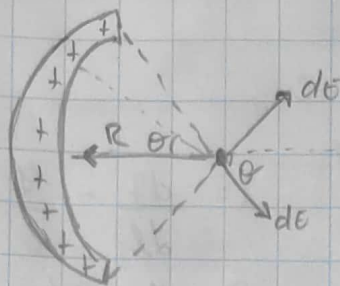
Problema 3:

$$q = +10 \text{ nC}$$

$$R = 0.15 \text{ m}$$

$$dq = \lambda ds$$

a)



$$dE = \frac{k dq}{r^2}$$

$$dE = \frac{k \lambda ds}{r^2}$$

$$dE = \frac{k \lambda R d\theta}{R^2} = \frac{k \lambda d\theta}{R}$$

$$E_y = 0$$

$$s = R\theta$$

$$ds = R d\theta$$

$$E = E_x = \int_0^{\pi/4} dE_x \cos\theta = \frac{2k\lambda}{R} \int_0^{\pi/4} \cos\theta d\theta = \frac{2k\lambda}{R} \sin\theta \Big|_0^{\pi/4}$$

$$E = \frac{2k\lambda}{R} [\sin \pi/4 - \sin 0] = \frac{2k q / \pi/2}{R} \sin \frac{\pi}{4}$$

$$E = \frac{2k (10 \times 10^{-9})}{\frac{\pi R}{2}} \sin \pi/4 = 3.6 \times 10^9 \text{ N/C}$$

$$E = 3.6 \times 10^9 \text{ N/C}$$

b)  $F = 0.1 \text{ N}$

$$E = \frac{F}{q} \Rightarrow q = \frac{F}{E} = \frac{0.1}{3.6 \times 10^9} = 27.78 \times 10^{-12}$$

$$q = 27.78 \times 10^{-12} \text{ C}$$

Problema 4.

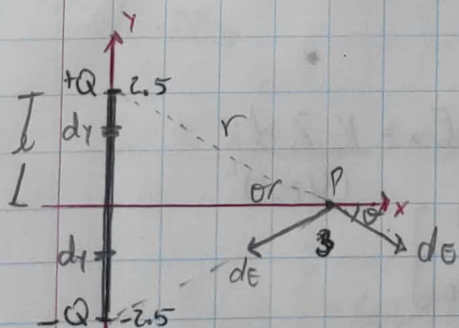
$$Q = 15 \text{ nC}$$

$$dE = \frac{k dq}{r^2} \quad dq = \lambda dy$$

$$E_x = 0$$

$$E_y = (-j)$$

$$dE = \frac{k \lambda dy}{r^2} = \frac{k \lambda dy}{(y^2 + 9)}$$



$$r = (y^2 + 3^2)^{1/2}$$

$$\lambda = \frac{Q}{L} = \frac{15 \text{ n}}{2.5} = 6 \text{ nC/m}$$

$$\sin\theta = \frac{y}{(y^2 + 9)^{1/2}}$$

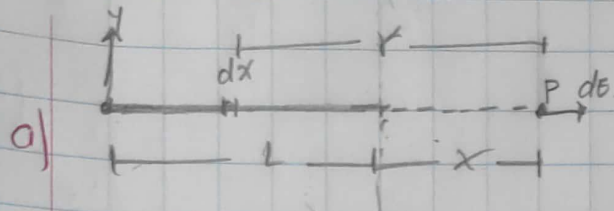
$$dE_y = dE \sin\theta = \frac{k \lambda dy}{(y^2 + 9)} \sin\theta = \frac{k \lambda dy}{y^2 + 9} \left( \frac{y}{(y^2 + 9)^{1/2}} \right) = \frac{2k \lambda y dy}{(y^2 + 9)^{3/2}}$$

$$E = 2k\lambda \int_0^{2.5} \frac{y dy}{(y^2 + 9)^{3/2}} = 108 \int_0^{2.5} \frac{y dy}{(y^2 + 9)^{3/2}}$$

$$E = 108 \int_0^{2.5} \frac{y dy}{(y^2 + 9)^{3/2}}$$



Problema 5:



$$q = 8 \text{ nC}$$

$$L = 10 \text{ m}$$

$$x = 1.50$$

$$\lambda = \frac{q}{L} = \frac{8 \text{ nC}}{10}$$

$$\lambda = 0.8 \text{ nC/m}$$

$$\lambda = 0.8 \text{ nC/m}$$

$$dq = \lambda dx$$

$$r = 11.5 - x$$

$$dE = \frac{k\lambda dx}{r^2}$$

$$dE = \frac{k\lambda dx}{(11.5 - x)^2} = k\lambda \int_0^{10} \frac{dx}{(11.5 - x)^2}$$

$$u = 11.5 - x$$

$$du = -dx$$

$$-du = dx$$

$$E = -k\lambda \int \frac{du}{u^2} = -k\lambda \left[ \frac{-1}{(11.5 - x)} \right]_0^{10} = -k\lambda \left( \frac{-1}{1.5} + \frac{1}{11.5} \right)$$

$$E = 4.17 \text{ n/C}$$

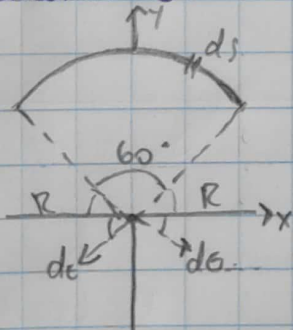
$$E = 4.17 \text{ n/C}$$

b)  $F = 0.8 \text{ N}$

$$q = \frac{F}{E} = \frac{0.8}{4.17} = 0.1918 \text{ C} \approx 191.8 \text{ mC}$$

$$F = 192 \text{ mC}$$

Problema 6:



$$q = 0.471 \text{ nC}$$

$$\theta = 60^\circ = \pi/3$$

$$R = 18 \text{ cm} = 0.18 \text{ m}$$

$$E_x = 0$$

$$E_y = -j$$

$$dq = \lambda ds$$

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

$$r = R$$

$$\lambda = \frac{0.471}{0.18 \theta} = 2.50$$

$$dE = 2E_y$$

$$E_y = \frac{k\lambda R d\theta \sin \theta}{R^2} \sin \theta = \frac{2k\lambda}{R} \int_{\pi/3}^{\pi/2} \sin \theta d\theta = \frac{2k\lambda}{R} \left[ -\cos \theta \right]_{\pi/3}^{\pi/2}$$

$$E_y = \frac{2k\lambda}{R} \left( -\cos \pi/2 + \cos \pi/3 \right) = \frac{2k\lambda}{R} \left( \frac{1}{2} \right) = 125 \text{ N/C}$$

$$E = 125 \text{ n/C}$$