PARCIAL #3 ~ MÉTODOS COMPUTACIONALES

PARTE TEÓRICA

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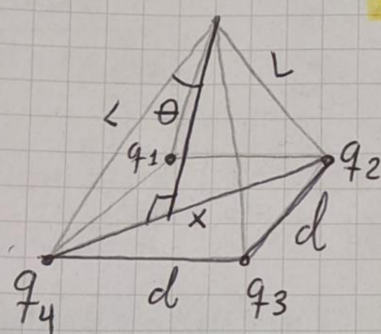
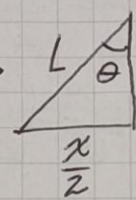
Punto de Referencia → q_4

① Hallo las distancias que separan las Cargas q_4 Y q_2 → x (Diagonal)

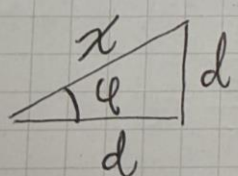




$$\operatorname{Sen}\theta = \frac{\frac{x}{2}}{\frac{L}{1}} \rightarrow \operatorname{Sen}\theta = \frac{x}{2L}$$

Distancia entre q_4 Y q_2 ← $x = \operatorname{Sen}\theta \cdot 2L$

② Hallo las distancias entre q_4 Y q_3 ; Y q_4 Y q_1 (Son la misma distancia)



$$x^2 = d^2 + d^2$$
$$x^2 = 2d^2$$
$$\frac{x^2}{2} = d^2$$

$$d = \sqrt{\frac{x^2}{2}}$$
$$d = x/\sqrt{2}$$

Racionalización

$$\frac{x}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2} \cdot x}{2}$$

$$d = x \cdot \frac{\sqrt{2}}{2} = \underbrace{\operatorname{Sen}\theta \cdot 2L}_{x} \cdot \frac{\sqrt{2}}{2} \rightarrow d = \operatorname{Sen}\theta \cdot L \cdot \sqrt{2}$$

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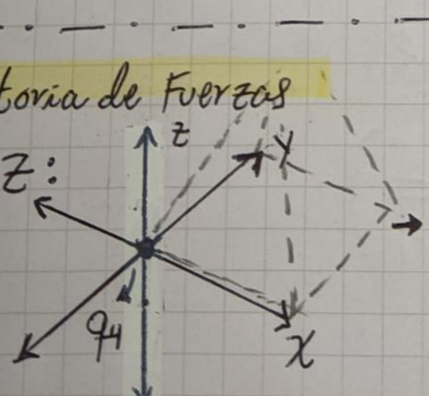
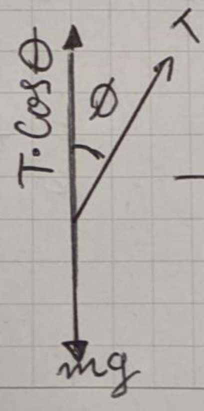
③ Sumatoria de Fuerzas

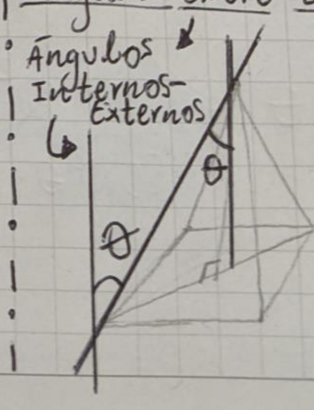
- Eje Z:





Ángulos entre 2 rectas

Ángulos Internos-Externos

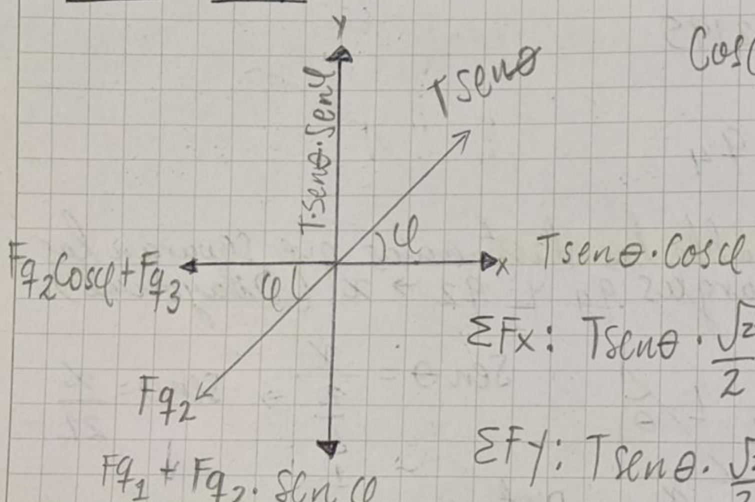


Ambos son el mismo ángulo θ.

Entonces, para el eje z tenemos que:

$\Sigma F_z: T\cos\theta - mg = 0$

Plano xy: (visto desde arriba)



$\cos(\varphi) = \dfrac{\cancel{\operatorname{sen}\theta} \cdot \cancel{K} \cdot \sqrt{2}}{\cancel{\operatorname{sen}\theta} \cdot 2 \cdot \cancel{K}} \rightarrow \cos(\varphi) = \dfrac{\sqrt{2}}{2}$

$\operatorname{Sen}(\varphi) = \dfrac{co}{h} = \dfrac{\sqrt{2}}{2}$

$\Sigma F_x: T\operatorname{sen}\theta \cdot \dfrac{\sqrt{2}}{2} - Fq_2 \cdot \dfrac{\sqrt{2}}{2} - Fq_3 = 0$

$\Sigma F_y: T\operatorname{sen}\theta \cdot \dfrac{\sqrt{2}}{2} - Fq_1 - Fq_2 \cdot \dfrac{\sqrt{2}}{2} = 0$

$\Sigma F_y: T\operatorname{sen}\theta \cdot \dfrac{\sqrt{2}}{2} - \dfrac{Q^2 \cdot k}{(\operatorname{sen}\theta \cdot 2 \cdot \sqrt{2})^2} - \dfrac{Q^2 \cdot k}{(\operatorname{sen}\theta \cdot 2 \cdot L)^2} \cdot \dfrac{\sqrt{2}}{2} = 0$

$\Sigma F_y: T\operatorname{sen}\theta \dfrac{\sqrt{2}}{2} - \dfrac{Q^2 \cdot k}{\operatorname{sen}^2\theta \cdot L^2 \cdot 2} - \dfrac{Q^2 \cdot k}{\operatorname{sen}^2\theta \cdot L^2} \cdot \dfrac{\sqrt{2}}{8} = 0$

$\Sigma F_x: T\operatorname{sen}\theta \cdot \dfrac{\sqrt{2}}{2} - \dfrac{k \cdot Q^2}{\operatorname{sen}^2\theta \cdot L^2 \cdot 2} - \dfrac{Q^2 \cdot k}{\operatorname{sen}^2\theta \cdot L^2} \cdot \dfrac{\sqrt{2}}{8} = 0$

$T\operatorname{sen}\theta \cdot \dfrac{\sqrt{2}}{2} = \left(\dfrac{kQ^2}{\operatorname{sen}^2\theta \cdot L^2}\right)\left(\dfrac{1}{2} + \dfrac{\sqrt{2}}{8}\right)$

$T\operatorname{sen}\theta = \dfrac{2}{\sqrt{2}} \cdot \left(\dfrac{kQ^2}{\operatorname{sen}^2\theta \cdot L^2}\right)\left(\dfrac{1}{2} + \dfrac{\sqrt{2}}{8}\right)$

$T\operatorname{sen}\theta = \left(\dfrac{k \cdot Q^2}{\operatorname{sen}^2\theta \cdot L^2}\right)\left(\dfrac{1}{\sqrt{2}} + \dfrac{1}{4}\right)$

$$\frac{\Sigma F x}{\Sigma F z} \rightarrow \frac{\cancel{T} \operatorname{sen}\theta = \dfrac{K \cdot Q^2}{\operatorname{sen}^2\theta \cdot L^2} \cdot \left(\dfrac{1}{\sqrt{2}} + \dfrac{1}{4}\right)}{\cancel{T} \cos\theta = mg}$$

$$\left(\frac{\operatorname{sen}^3\theta}{\cos\theta}\right)^2 = \left(\frac{K \cdot Q^2}{L^2 \cdot mg} \cdot \left(\frac{1}{\sqrt{2}} + \frac{1}{4}\right)\right)^2$$

$$\frac{\operatorname{sen}^6\theta}{(1 - \operatorname{sen}^2\theta)} = \frac{K^2 \cdot Q^4}{L^4 \cdot W^2} \cdot \left(\frac{1}{\sqrt{2}} + \frac{1}{4}\right)^2$$

$$\operatorname{sen}^6\theta = (1 - \operatorname{sen}^2\theta)\left[\frac{K^2 \cdot Q^4}{L^4 \cdot W^2} \cdot \left(\frac{1}{\sqrt{2}} + \frac{1}{4}\right)^2\right]$$

$$\operatorname{sen}^6\theta = \left[\frac{K^2 \cdot Q^4}{L^4 \cdot W^2} \cdot \left(\frac{1}{\sqrt{2}} + \frac{1}{4}\right)^2\right] - \operatorname{sen}^2\theta \cdot \left[\frac{K^2 \cdot Q^4}{L^4 \cdot W^2} \cdot \left(\frac{1}{\sqrt{2}} + \frac{1}{4}\right)^2\right]$$

$$\operatorname{sen}^6\theta + \left[\frac{K^2 \cdot Q^4}{L^4 \cdot W^2} \cdot \left(\frac{1}{\sqrt{2}} + \frac{1}{4}\right)^2\right] \operatorname{sen}^2\theta - \left[\frac{K^2 \cdot Q^4}{L^4 \cdot W^2}\left(\frac{1}{\sqrt{2}} + \frac{1}{4}\right)^2\right] = 0$$

Tomando a $\left[\frac{K^2 \cdot Q^4}{L^4 \cdot W^2} \cdot \left(\frac{1}{\sqrt{2}} + \frac{1}{4}\right)^2\right]$ como $\mathcal{K}$, se llega a la siguiente expresión:

$$\operatorname{sen}^6\theta + \mathcal{K} \operatorname{sen}^2\theta - \mathcal{K} = 0 \rightarrow \text{RTA}$$

Finalmente, hallando el valor de $\mathcal{K} = \frac{K^2 \cdot Q^4}{L^4 \cdot W^2} \cdot \left(\frac{1}{\sqrt{2}} + \frac{1}{4}\right)^2$,

donde $K = 9 \times 10^9$; $Q = q = 3 \times 10^{-4}$;

$L = 5$; $W = 114,6$; se tiene que:

$$\mathcal{K} = \frac{K^2 \cdot q^4}{L^4 \cdot W^2} \cdot \left(\frac{1}{\sqrt{2}} + \frac{1}{4}\right)^2$$

$$\mathcal{K} = \frac{(9 \times 10^9)^2 \cdot (3 \cdot 10^{-4})^4}{(5)^4 \cdot (114,6)^2} \cdot \left(\frac{1}{\sqrt{2}} + \frac{1}{4}\right)^2$$

$$\mathcal{K} = 0,07322.$$