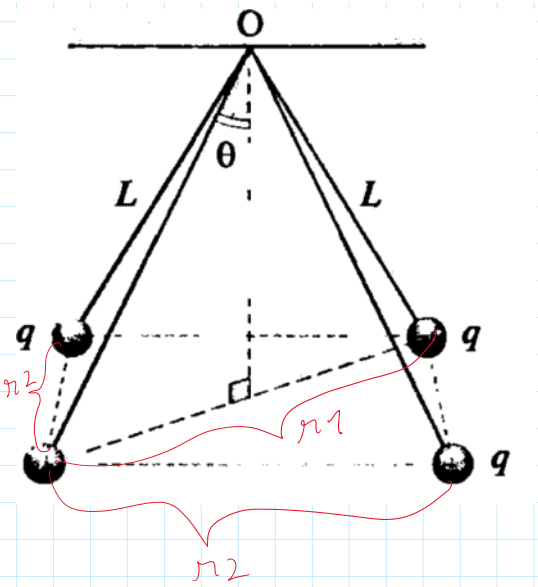
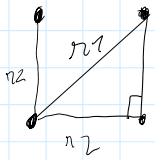
Preparcial 3 parte teórica

miércoles, 8 de noviembre de 2023 8:43 a. m.

21. *Calculo de raíces en física:* Cuatro esferas de pesos iguales $w = 114.6\ N$ y cargas iguales $q = 3 \times 10^{-4}\ C$ se encuentran en los extremos de hilos inelásticos y aislantes de longitudes $L = 5\ m$. Los que a su vez se encuentran unidos en $\mathcal{O}$. Para la aplicación numérica use $g = 10\ m/s^2$ (Tomado de [5]).



Vista de arriba



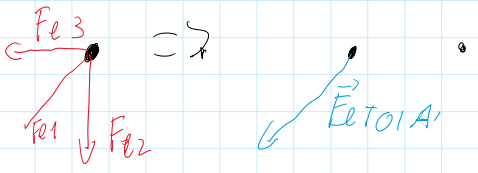
$r2^2 + r2^2 = r1^2$

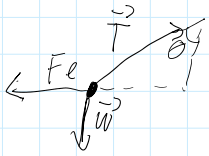
$r2^2 = \left(\frac{2\sin\theta \cdot L}{2}\right)^2$

$r2^2 = \frac{2^2 \sin^2\theta \cdot L^2}{2} = 2\sin^2\theta \cdot L^2$

$r2 = \sqrt{2 \cdot \sin^2\theta \cdot L^2}$

$r2 = \sqrt{2} \cdot \sin\theta \cdot L$





$$Fe = k\frac{q^2}{(2\sin\theta \cdot L)^2} + \sqrt{\left(\frac{kq^2}{(\sqrt{2}\sin\theta \cdot L)^2}\right)^2 + \left(\frac{kq^2}{(\sqrt{2}\sin\theta \cdot L)^2}\right)^2}$$

$$= \frac{k\,q^2}{4\sin^2\theta \cdot L^2} + \sqrt{\frac{2k^2q^4}{4\sin^4\theta L^4}}$$

$$= \frac{k\,q^2}{4\sin^2\theta L^2} + \frac{\sqrt{2}}{2}\frac{kq^2}{\sin^2\theta \cdot L^2}$$

$$= \frac{kq^2}{\sin^2\theta \cdot L^2}\left(\frac{1}{4} + \frac{\sqrt{2}}{2}\right) = \frac{kq^2}{\sin^2\theta \cdot L^2}\left(\frac{1}{4} + \frac{\sqrt{2}}{2}\right)$$

$r1/2 = 2\sin\theta \cdot L$

$r1 = 2\sin\theta \cdot L$

$r2 = \sqrt{2}\ \sin\theta \cdot L$

Eje y: $W = \|T\| \cdot \cos\theta$

$\|T\| = \frac{W}{\cos\theta}$

Eje x: $Fe = \|T\| \sin\theta$

$Fe = \frac{W\sin\theta}{\cos\theta}$

Nos quedamos con esta expresión:

$$\frac{5}{4}\frac{kq^2}{\sin^2\theta \cdot L^2} = \frac{W\sin\theta}{\cos\theta}$$

$$\frac{\cos\theta}{\sin^3\theta} = \frac{4}{5}\frac{W \cdot L^2}{kq^2}$$

$$\frac{\sin^3\theta}{\cos\theta} = \frac{5}{4}\frac{kq^2}{WL^2}$$

$$\frac{\sin^3\theta}{\cos\theta} = \frac{5}{4}\frac{kq^2}{WL^2}$$

$$\left(\frac{\sin^3\theta}{\cos\theta} = \frac{5}{4}\frac{kq^2}{WL^2}\right)^2$$

$$\frac{\sin^6\theta}{\cos^2\theta} = \left(\frac{\sqrt{2}}{2} + \frac{1}{4}\right)\frac{k^2q^4}{W^2L^4} = \alpha$$

$\alpha = 0{,}732$

$\sin^6\theta = \alpha \cdot \cos^2\theta$

$$\frac{\sin^3\theta}{\cos\theta} = \frac{5}{4}\,\frac{k\,q^2}{WL^2}$$

$$\sin^6\theta = \alpha\cdot\cos^2\theta$$

$$\sin^6\theta = \alpha\,(1-\sin^2\theta)$$

$$\sin^6\theta = \alpha - \alpha\sin^2\theta$$

$$\boxed{\sin^6\theta + \alpha\sin^2\theta - \alpha = 0}$$