Reposo

P1

$X(0) = X_0 \qquad v(0) = 0.$

$F = \frac{k}{X^3} \rightarrow$ Conservativa? $\underline{SI}$

$\vec{F} \parallel d\vec{r}.$

Por definición.

$$V(x) = -\int \frac{k}{x^3}\,dx = \frac{k}{2x^2}$$

$$t - \cancel{t_0} = \sqrt{\frac{m}{2}} \int_{x_0}^{x} \left[E - V(x)\right]^{-1/2} dx$$

$$E = \cancel{T_0} + V(0) = \frac{k}{2x_0^2}$$

Sustituyendo.

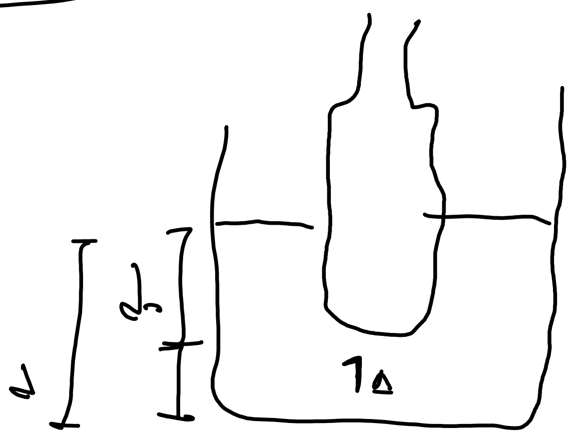
$$t = \sqrt{\frac{m}{2}} \int_{x_0}^{x} \left[\frac{k}{2x_0^2} - \frac{k}{2x^2}\right]^{-1/2} dx$$

$$t = \sqrt{\frac{m}{2}} \int_{x_0}^{x} \sqrt{\frac{2}{k}} \underbrace{\left(\frac{x^2 - x_0^2}{x_0^2 x^2}\right)}^{-1/2} dx$$

$$x_0\int_{x_0}^{x}\frac{x}{\sqrt{x^2-x_0^2}}\,dx$$

$$t=\sqrt{\frac{m}{k}}\,x_0\sqrt{x^2-x_0^2}\rightarrow x(t)=\left[x_0^2+\frac{k t^2}{m x_0^2}\right]^{1/2}$$

P2)



Primero: En reposo

$$mg=\rho g A d_0 \qquad (1)$$

$$\hookrightarrow \rho g A=\frac{mg}{d_0}$$

2) Cuando la desplazamos

$$m\ddot{x}=mg-\rho g A(d_0+x)=\underbrace{mg-\rho g A d_0}_{\substack{\text{dado } =0\\(1)}}-\rho g A x$$

$$\cancel{m}\ddot{x}=-\rho g A x=-\frac{\cancel{m}gx}{d_0}\rightarrow\boxed{\ddot{x}+\frac{g}{d_0}x=0}$$

? ?

MAS!

$\omega = \sqrt{g/d_o}$

P4, 2020 Parcial 2

Teniendo la ec.

$$y^2 = 4f_o^2 - 4f_o x$$

en Cartesianas.

$$\underbrace{x^2+y^2}_{r^2} = \underbrace{4f_o^2 - 4f_o x + x^2}_{(2f_o - x)^2}$$

$$r = \pm(2f_o - x)$$ → Tomando la raiz negativa.

$$\dot{r} = \dot{x} = v_x \qquad (1)$$

$$\Rightarrow r^2 = x^2 + y^2 \longrightarrow \dot{r} = \frac{x}{r}\dot{x} + \frac{y}{r}\dot{y}$$

Sabiendo que
$$\left.\begin{aligned} x &= r\cos(\theta) \\ y &= r\,\text{sen}(\theta) \end{aligned}\right\}$$

$$\dot{r} = \cos(\theta)\dot{x} + \operatorname{sen}\theta\,\dot{j}$$

$$\Rightarrow \dot{x} = \cos\theta\dot{x} + \operatorname{sen}\theta\,\dot{y} \rightarrow \dot{x} = \frac{\operatorname{sen}\theta}{1-\cos\theta}\dot{y} \quad (2)$$

Ahora, sabiendo que v = cte.

$$v^2 = \dot{x}^2 + \dot{y}^2 \quad (3)$$

$$v^2 = \underbrace{\frac{\operatorname{sen}^2\theta}{(1-\cos\theta)^2}\dot{y}^2 + \dot{y}^2}$$

$$\frac{\operatorname{sen}^2\theta + (1-\cos\theta)^2}{(1-\cos\theta)^2} = \frac{\cancel{\operatorname{sen}^2\theta + \cos^2\theta}^{\,1} - 2\cos\theta + 1}{(1-\cos\theta)^2}$$

$$= \frac{1-2\cos\theta}{(1-\cos\theta)^2}$$

$$\dot{y} = \operatorname{sen}(\theta/2)\,v$$

$$\dot{x} = \cos(\theta/2)\,v.$$

En polares $v_r = \dot{r}$

$v_\theta = r\dot{\theta}$

para

$v_r = \cos(\theta/2)\, v$

$r = x - 2f_0 \quad ; \quad x = r\cos\theta$

$r(1-\cos\theta) = -2f_0$

$\dot{r}(1-\cos\theta) + r\,\text{sen}\,\theta\,\dot{\theta} = 0$

Despejando $r\dot{\theta} = -\left(\dfrac{1-\cos\theta}{\text{sen}\,\theta}\right)\dot{r}$

$v_\theta = r\dot{\theta} = -\left(\dfrac{1-\cos\theta}{\text{sen}\,\theta}\right)\cos(\theta/2)\, v$