P1)

$$x(t) = A\cos(\omega t - \phi_0)$$

Cond Ini : $x(0) = x_0$ (1)

$\dot{x}(0) = v_0$ (2)

(1) $\Rightarrow$ $A\cos\phi_0 = x_0$ (3)

$$\dot{x}(t) = -A\omega\sin(\omega t - \phi_0)$$

(2) $\Rightarrow$ $+A\omega\sin\phi_0 = v_0$ (4)

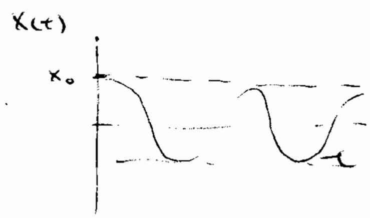
(4)/(3) $\Rightarrow$ $\omega\tan\phi_0 = \frac{v_0}{x_0}$

$$\Rightarrow \boxed{\tan\phi_0 = \frac{v_0}{\omega x_0}}$$

$(3)^2 + ((4)/\omega)^2 \Rightarrow$ $A^2 = x_0^2 + \left(\frac{v_0}{\omega}\right)^2$

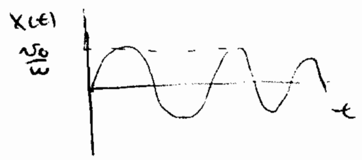
$$\therefore \quad x(t) = \sqrt{x_0^2 + \left(\frac{v_0}{\omega}\right)^2}\cos\left(\omega t - \tan^{-1}\left(\frac{v_0}{\omega x_0}\right)\right)$$

- Si $v_0 = 0$ $\Rightarrow$ $x(t) = x_0\cos(\omega t)$

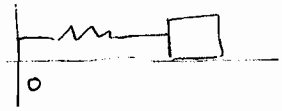


- Si $x_0 = 0$ $\Rightarrow$ $x(t) = \frac{v_0}{\omega}\cos(\omega t - \pi/2)$

$$= \frac{v_0}{\omega}\sin(\omega t)$$



P2 $\ddot{x} + w^2 x + b = 0$



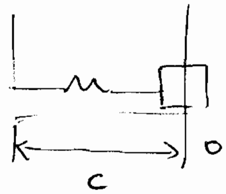
$x(t) = z(t) + c$ $\quad$ c por determinar

$\Rightarrow \ddot{z} + w^2(z + c) + b = 0$

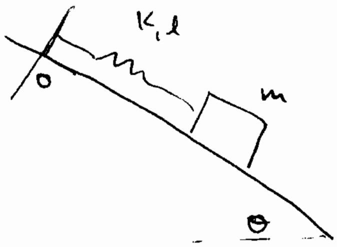
$\Rightarrow \ddot{z} + w^2 z + \underbrace{w^2 c + b}_{=0 \text{ (se impone)}} = 0$

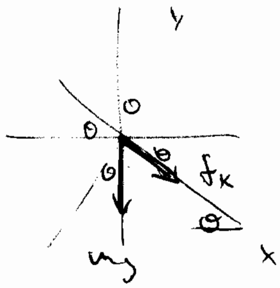
$\Rightarrow \ddot{z} + w^2 z = 0$

con $c = -\dfrac{b}{w^2}$



P3





x) $\underbrace{f_K}_{-K(x-l_0)} + mg \sin\theta = m\ddot{x}$

$\Rightarrow m\ddot{x} + K(x - l_0) - mg \sin\theta = 0$

$\ddot{x} + \dfrac{K}{m} x + \underbrace{-g \sin\theta - \dfrac{K}{m} l_0}_{b} = 0 \qquad (1)$

~~cambio variable $\ddot{z} = \ddot{x} - g\sin\theta - \dfrac{K}{m} l_0$~~

~~$\Rightarrow \ddot{z} + w_0^2 z = 0 \qquad w_0 = \sqrt{\dfrac{K}{m}}$~~

$$\ddot{x} + \omega x + b = 0 \qquad \omega = \sqrt{\frac{k}{m}}$$

$$b = -\left(g \sin\theta + \frac{k}{m} l_0\right)$$

Cambio variable $z = x + \frac{b}{\omega^2}$

$$z = x - \left(g \sin\theta + \frac{k}{m} l_0\right)\frac{m}{k}$$

$$z = x - \left(\frac{mg}{k}\sin\theta + l_0\right)$$

$$\Rightarrow \quad \ddot{z} + \omega^2 z = 0$$

$$\Rightarrow \quad z(t) = A\cos(\omega t + \phi)$$

$$\Rightarrow \quad \boxed{x(t) = A\cos(\omega t + \phi) + l_0 + \frac{mg}{k}\sin\theta}$$

pos. eq $\dot{x} = \ddot{x} = 0$

(1) $\Rightarrow$ ~~$\omega x + b = 0$~~ $\frac{k}{m} x - \left(g \sin\theta + \frac{k}{m} l_0\right) = 0$

$$\boxed{x_{eq} = l_0 + \frac{mg}{k}\sin\theta}$$