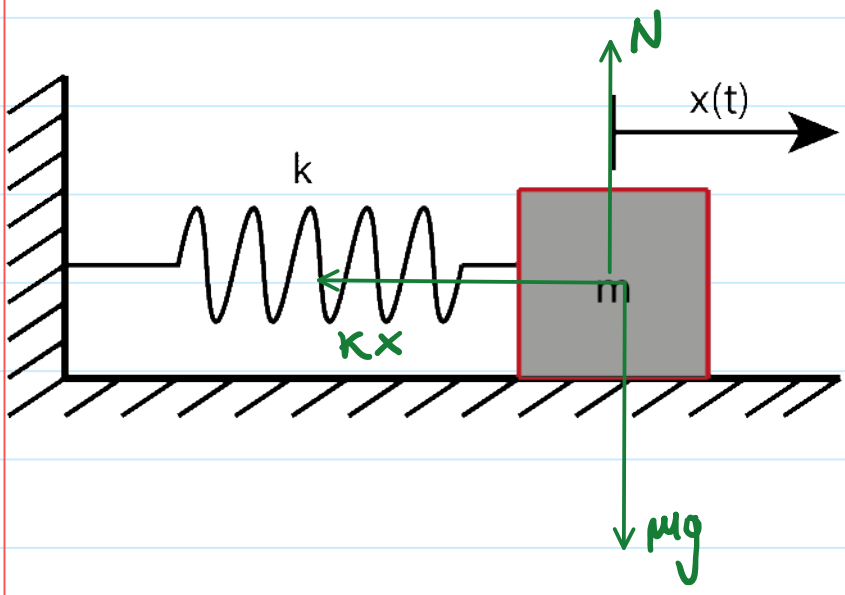
# Auxiliar 1

Pregunta 1:




$\hat{x}$ | $M\ddot{x} = -kx$

$\hat{y}$ | $M\ddot{y} = N - Mg$ ($\ddot{y} = 0$)

↳ $N = Mg$

EC de MOV: $\ddot{x} + \frac{k}{M}x = 0$ $\xrightarrow{\frac{k}{M}=\omega^2}$ $\boxed{\ddot{x} + \omega^2 x = 0}$

$x(t) = A\cos(\omega t + \phi)$

$\dot{x}(t) = -A\omega \operatorname{sen}(\omega t + \phi)$

$\ddot{x}(t) = -A\omega^2 \cos(\omega t + \phi)$

$= -\omega^2 A\cos(\omega t + \phi)$

$= -\omega^2 x(t)$

$-\omega^2 x(t) + \omega^2 x(t) = 0$ ✓✓

$\tau_q(t) = B\cos(\omega t) + c\operatorname{sen}(\omega t)$ ✓

$\dot{\tau}_q(t) = -B\omega \operatorname{sen}(\omega t) + c\omega\cos(\omega t)$

$\ddot{\tau}_q(t) = -B\omega^2\cos(\omega t) - c\omega^2 \operatorname{sen}(\omega t) = -\omega^2\left(B\cos(\omega t) + c\operatorname{sen}(\omega t)\right)$

$= -\omega^2 \tau_q$

$\ddot{\tau}_q + \omega^2 \tau_q = 0$

$\tau_q \stackrel{?}{=} A e^{i(\omega t + \phi)}$

$-\omega^2\tau_q + \omega^2\tau_q = 0$ ✓

# Auxiliar 1

$\ddot{\zeta} + \omega^2 \zeta = 0$

$\zeta(t) = B\cos(\omega t) + C\,\text{sen}(\omega t)$

$x_0 = 2{,}5\,m \qquad v_0 = 0\ m/s$

$\zeta(t=0) \qquad \dot{\zeta}(t=0)$

$\zeta(t=0) = B\cos(0) + C\,\text{sen}(0) = B = x_0 = 2{,}5$

$\dot{\zeta}(t=0) = -B\omega\,\text{sen}(0) + C\omega\cos(0) = C\omega = 0 \rightarrow \boxed{C=0}$

$\boxed{B=2{,}5}$

$\boxed{\zeta(t) = 2{,}5\cos(t)}$

$x_0 = 2{,}5\,m \qquad v_0 = 0\ m/s \qquad x(t) = A\cos(\omega t + \phi)$

$x(t=0) = A\cos(\phi) = 2{,}5 \rightarrow A = 2{,}5$

$\dot{x}(t=0) = -A\omega\,\text{sen}(\phi) = 0 \rightarrow \text{sen}\,\phi = 0 \rightarrow \boxed{\phi = 0}$

$\boxed{x(t) = 2{,}5\cos(t)}$

# Auxiliar 1

$x_0 = 2\,m \qquad v_0 = -1\,m/s \qquad q(t) = B\cos(\omega t) + C\,\text{sen}(\omega t)$

$q(t=0) = B = 2 \rightarrow \boxed{B = 2}$

$\dot{q}(t=0) = C\omega = -1 \Rightarrow \boxed{C = -1}$

$$\boxed{q(t) = 2\cos(t) - \text{sen}(t)}$$

$x_0 = 2m \qquad v_0 = -1\,m/s \quad | \quad x(t) = A\cos(\omega t + \phi)$

$x(t=0) = A\cos(\phi) = 2 \quad (1) \rightarrow \quad A = \dfrac{2}{\cos(\phi)}$

$\dot{x}(t=0) = -A\omega\,\text{sen}(\phi) = -1 \quad (2)$

$$\frac{\dot{x}(t=0)}{x(t=0)} = \frac{+A\omega\,\text{sen}(\phi)}{A\cos(\phi)} = \frac{+1}{2} = \omega\, tg(\phi)$$

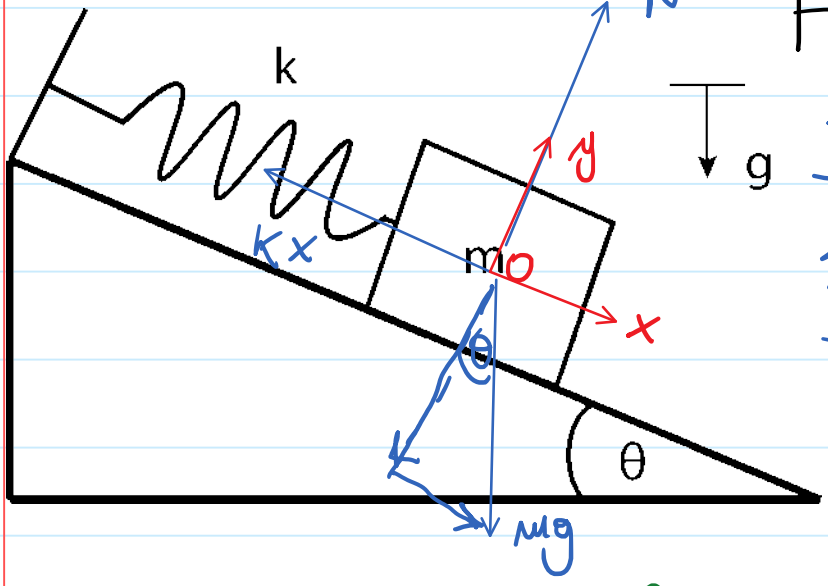
$\phi = \text{Arctg}(1/2) \qquad x(t) = A\cos(\omega t + \phi)$

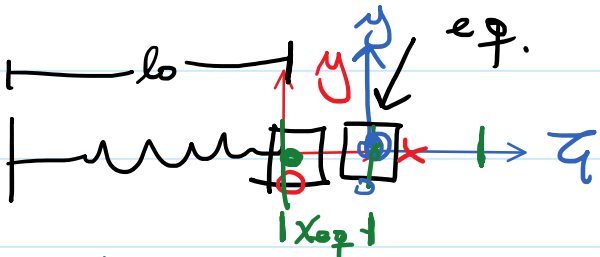
$$A = \frac{2}{\cos(\text{Arctg}(1/2))}$$

$$x(t) = \frac{2}{\cos(\text{Arctg}(1/2))}\cos(1\cdot t + \text{Arctg}(1/2))$$

# Auxiliar 1

Pregunta 2




$\hat{x}$ | $-KX + mg\,sen\theta = m\ddot{x}$

$\hat{y}$ | $N - mg\cos\theta = m\ddot{y}^{0} = 0$

$N = mg\cos\theta$

$$-KX + mg\,sen\theta = m\ddot{x}$$

Equilibrio ($\ddot{x} = 0$) $\quad -KX_{eq} + mg\,sen\theta = 0$

$$X_{eq} = \frac{mg\,sen\theta}{K}$$

$$X(t) = X_{eq} + \zeta(t) \rightarrow \dot{x}(t) = \dot{\zeta}(t) \rightarrow \ddot{x}(t) = \ddot{\zeta}(t)$$

$$-K(X_{eq} + \zeta) + mg\,sen\theta = m\ddot{\zeta}$$

$$-K\left(\frac{mg\,sen\theta}{K} + \zeta\right) + mg\,sen\theta = m\ddot{\zeta}$$

$$-mg\,sen\theta - K\zeta + mg\,sen\theta = m\ddot{\zeta}$$

$$-K\zeta = m\ddot{\zeta} \rightarrow \ddot{\zeta} + \omega^2\zeta = 0 \quad / \quad \omega^2 = \frac{K}{m}$$

$$-k\eta = m\ddot{\eta} \longrightarrow \boxed{\ddot{\eta} + \omega^2 \eta = 0} \quad / \quad \boxed{\omega^2 = \frac{k}{m}}$$

# Auxiliar 1

$$q(t) = B\cos(\omega t) + C\,\mathrm{sen}(\omega t) \quad \Big| \quad q(t=0)=0 \wedge \dot{q}(t=0)=v_0$$

$$\ddot{q}(t) = -B\omega\,\mathrm{sen}(\omega t) + C\omega\cos(\omega t)$$

$$q(t=0) = B = 0 \rightarrow \boxed{B=0}$$

$$\dot{q}(t=0) = C\omega = v_0 \qquad \boxed{C = \frac{v_0}{\omega}}$$

$$\boxed{q(t) = \frac{v_0}{\omega}\,\mathrm{sen}(\omega t)} \wedge \boxed{\dot{q}(t) = v_0\cos(\omega t)}$$