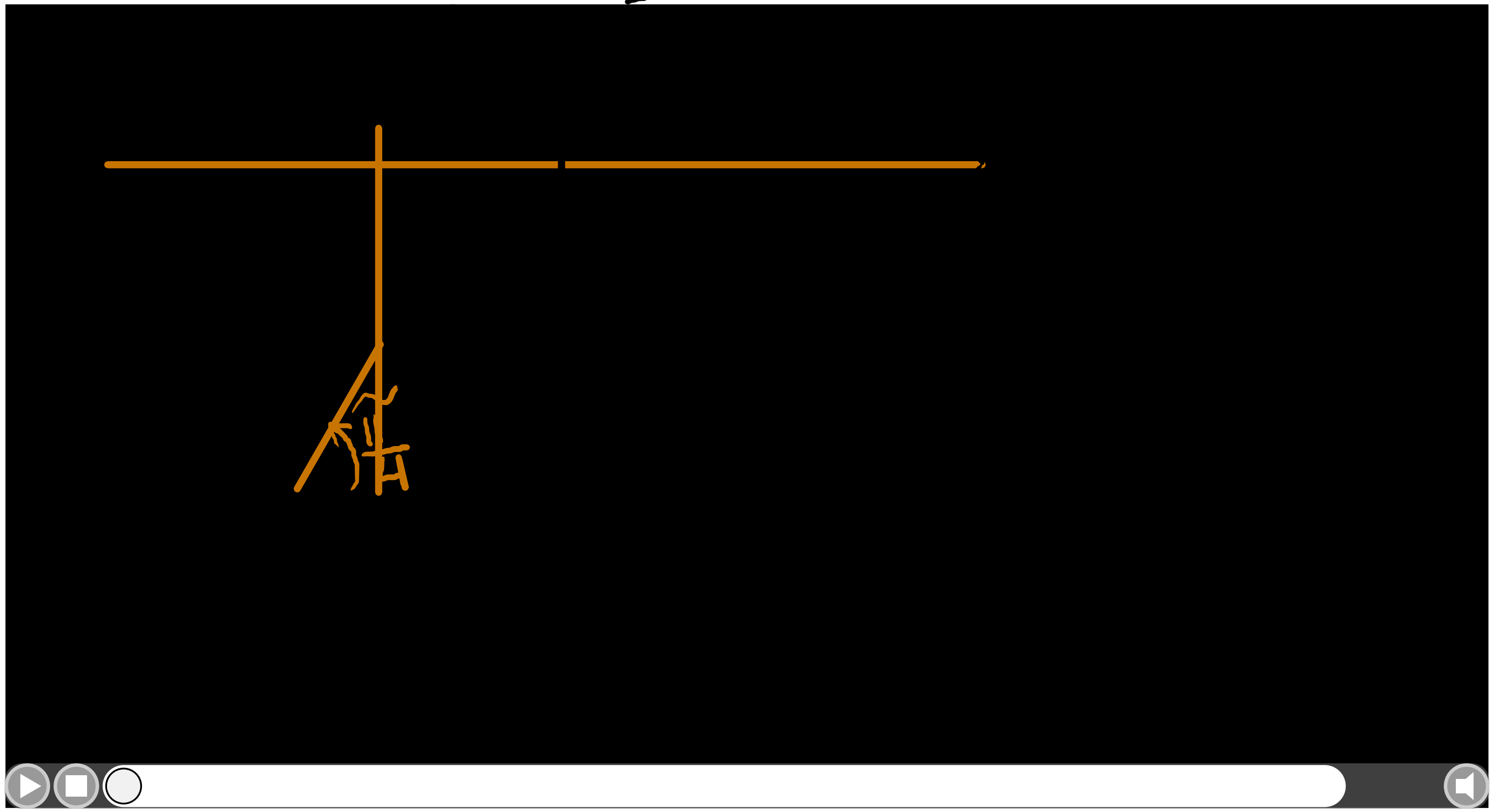


$$\cos\phi = \frac{\sqrt{2}}{2}$$

$$0 \leq \phi < 2\pi$$

$$\phi = \frac{\pi}{4}\ \text{rad}$$

$$\phi = \frac{7\pi}{4}\ \text{rad}.$$

$$\vec{R} = \vec{F} + \vec{N} + m\vec{g} = \vec{F}$$

2a lei de Newton: $F = -kx = ma$

$$a(x) = -\frac{k}{m}x = -\omega^2 x \Rightarrow \boxed{\omega = \sqrt{\frac{k}{m}}}$$

$$x(t) = x_m \cos(\omega t + \phi). \qquad \omega = \sqrt{\frac{k}{m}}.$$

$$x(t=0) = x_0 = x_m \Rightarrow \phi = 0$$

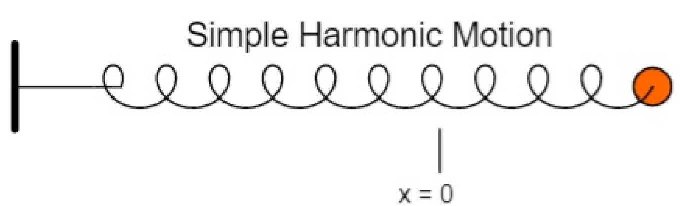
$$x_0 = x_m \cos\phi \Rightarrow \cos\phi = \frac{x_0}{x_m}$$

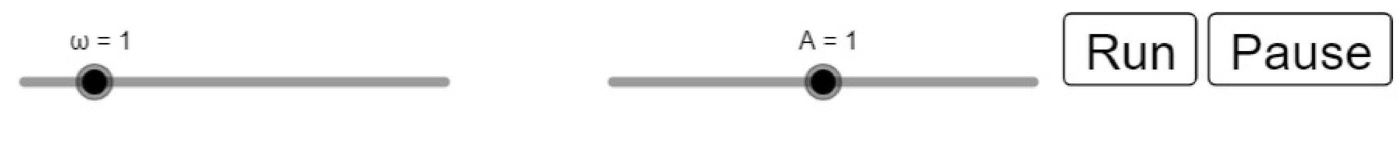
$$v(t) = -\omega x_m \sin(\omega t + \phi) \Rightarrow$$

$$v_0 = v(t=0) = -\omega x_m \sin\phi \Rightarrow \sin\phi = \frac{-v_0}{\omega x_m}$$

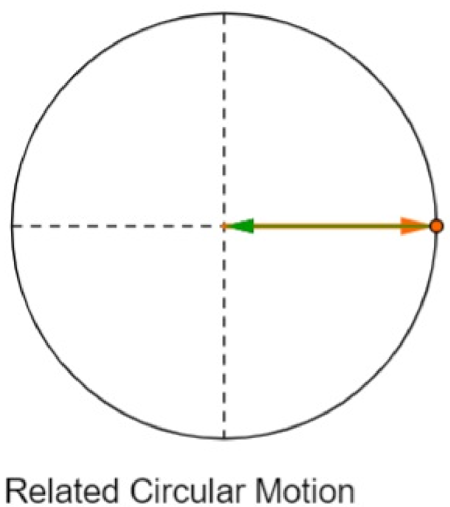
A constante de fase é determinada pelas condições iniciais do movimento.

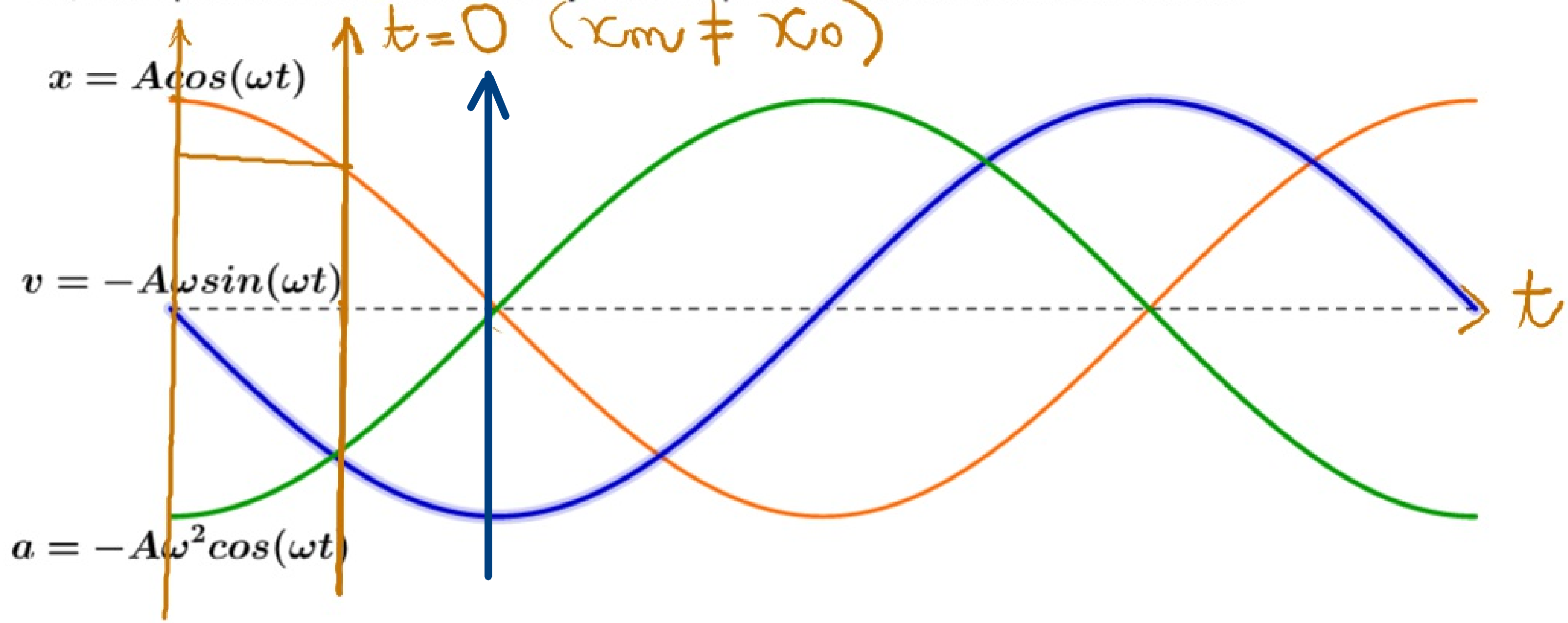
A frequência angular não depende das condições iniciais.





So, our equations of motion for an object in Simple Harmonic Motion are as follows:


Related Circular Motion



$$\cos\phi = \frac{x_0}{x_m} \quad ; \qquad \sin\phi = \frac{-v_0}{v_m}$$

$$\sin^2\phi + \cos^2\phi = 1 \Rightarrow \frac{x_0^2}{x_m^2} + \frac{v_0^2}{\omega^2 x_m^2} = 1.$$

$$\boxed{x_m = \left(x_0^2 + \frac{v_0^2}{\omega^2} \right)^{1/2}}$$

Se $t = 0$ é tal que: $x_0 = \pm x_m$; $v_0 = 0$

Se $t = 0$ é tal que: $x_0 = 0$; $v_0 = \pm v_m$

$$x_m = \left(\frac{v_m}{\omega} \right)$$

MRUV: $\boxed{x(t) = x_0 + v_0 t + \frac{1}{2} a t^2}$

$$\begin{cases} \text{Condições iniciais: } (x_0, v_0) \\ \text{Resultante: } \vec{a} = \vec{R}/m \end{cases}$$

Entrada: $(x_0, v_0, F = -kx)$

$\downarrow$ caracteriza o MHS.

$$F = -kx = ma$$

$$\Downarrow$$

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

$$x(t) = x_m \cos(\omega t + \phi).$$

$$\omega = \left(\frac{k}{m}\right)^{1/2}$$

$$\cos\phi = \frac{x_0}{x_m}$$

$$x_m = \left(x_0^2 + \frac{v_0^2}{\omega^2}\right)^{1/2};$$

$$\sin\phi = -\frac{v_0}{\omega x_m}$$