APSC-112

January 9th

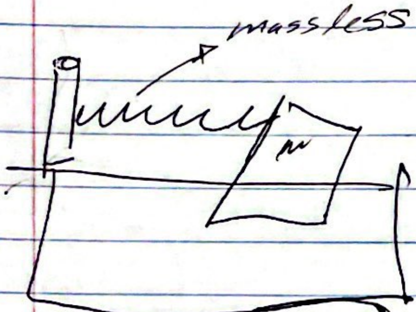
Simple Harmonic Motion

period [T] (s) how long to go back / forth

frequency

f [1/s, Hz]

has restoring force of form: $F_x = -kx$ (Hooke's law)



$$ma = -kx$$

$$a = -\frac{kx}{m} = \frac{d^2x}{d^2t}$$

$\frac{d^2x}{dt^2}$ $x \to x(t)$

$$\boxed{\frac{d^2x}{dt^2} + \frac{k}{m}x = 0}$$ differential equation of motion

Best way to solve is to guess an answer

~~x(t) = cos~~ $x(t) = A\cos(\omega_0 t + \phi)$

So $\frac{dx}{dt} = -A\omega_0 \sin(\omega_0 t + \phi)$

$$\frac{d^2x}{dt^2} = -A\omega_0^2 \cos(\omega_0 t + \phi)$$

So $a(t) = \frac{d^2x}{dt}$

$$\left[-\omega_0^2 + \frac{k}{m}\right] x(t) = 0$$

$-\omega_0^2 + \frac{k}{m} = 0$ $\omega_0^2 = \frac{k}{m}$ ~~ω_0~~

$\omega_0 = \sqrt{\frac{k}{m}}$

Hilroy

Scanned with CamScanner

SHM solution

$x(t) = A\cos(\omega_0 t + \phi)$

$A \rightarrow$ amplitude

$\omega_0 \rightarrow$ angular frequency

$\phi \rightarrow$ shifts the start of the function