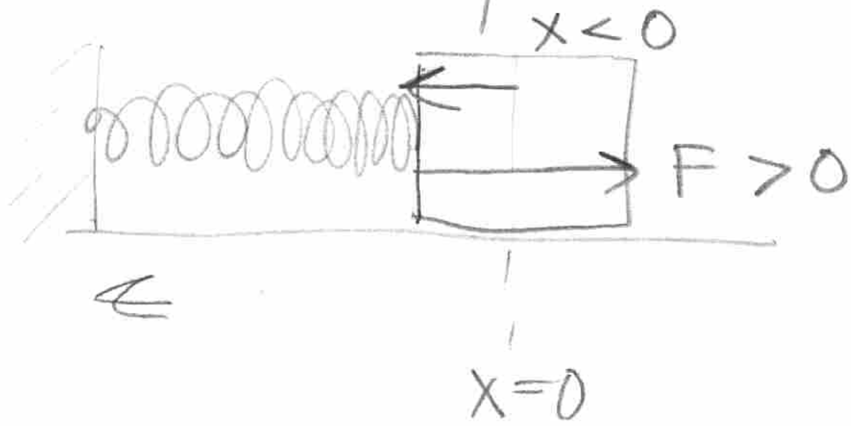
Works other way too



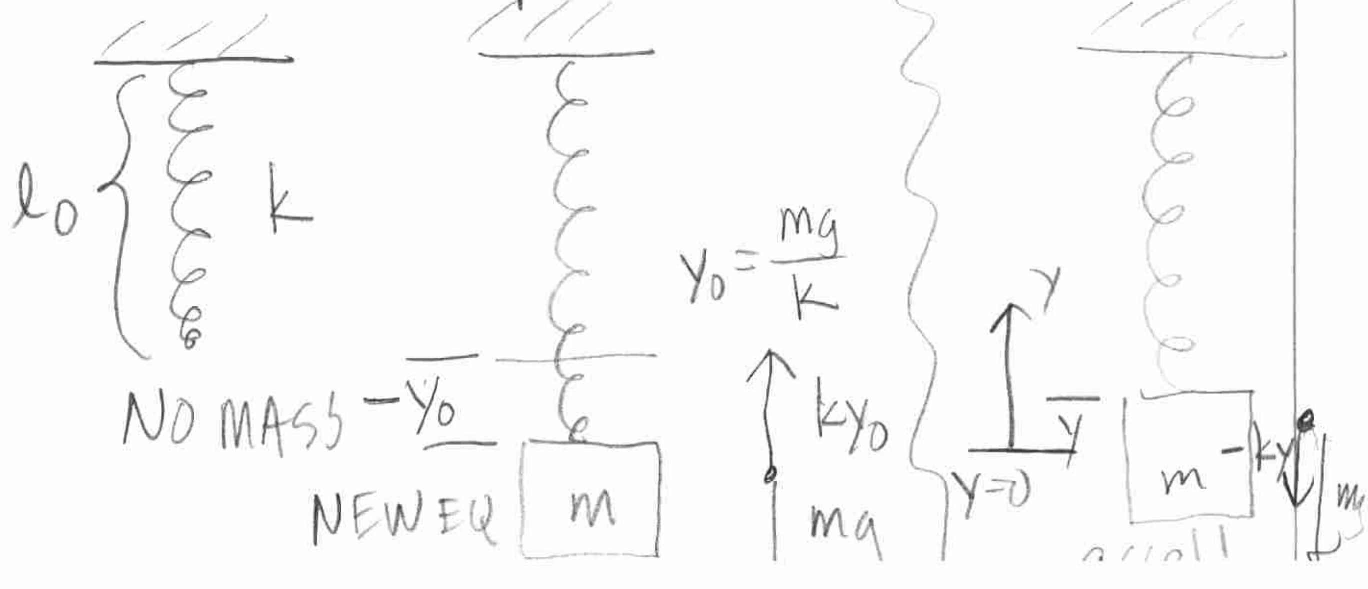

when $x=0$, spring has "equilibrium length"

"$l_0$"

<u>STATIC</u>: $l_0$, $x=0$

<u>DYNAMIC</u> (time variation) $x \neq 0$

<u>Vertical</u>: First spring stretches to new equilibrium $> l_0$



$$m\ddot{x} = -kx$$

second derivative is proportional to − function.

$\sin\theta$, $\frac{d}{d\theta}\sin\theta = \cos\theta$, $\frac{d^2\sin\theta}{d\theta^2} = -\sin\theta$

$\cos\theta$, $\frac{d}{d\theta}\cos\theta = -\sin\theta$, $\frac{d^2\cos\theta}{d\theta^2} = -\cos\theta$

Try... $x(t) = A\sin(\alpha t) + B\cos(\beta t)$

JUST A SMART GUESS

$$\dot{x}(t) = A\alpha\cos(\alpha t) - B\beta\sin(\beta t)$$

$$\ddot{x}(t) = -A\alpha^2\sin(\alpha t) - B\beta^2\cos(\beta t)$$

$$m\left[-A\alpha^2\sin(\alpha t) - B\beta^2\cos(\beta t)\right] \stackrel{?}{=} -k\left[A\sin\alpha t + B\cos\beta t\right]$$

(i) $\beta = \alpha$ or that term won't factor

(ii) $m\alpha^2 = k$

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

$$x(t) = A\sin\left(\sqrt{\frac{k}{m}}\,t\right) + B\cos\left(\sqrt{\frac{k}{m}}\,t\right)$$

Argument of sin/cos is in <u>RADIANS</u>

$\sqrt{\frac{k}{m}} \longrightarrow$ radians/second

$\longrightarrow$ like.. $\underline{\underline{\omega}}$ <u>angular velocity</u>

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

$$x(t) = A\sin(\omega t) + B\cos(\omega t)$$

$$\omega T = 2\pi \quad \Rightarrow \quad T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{m}{k}}$$

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In specific case, A, B determined by.. $x(0)$, $\dot{x}(0)$