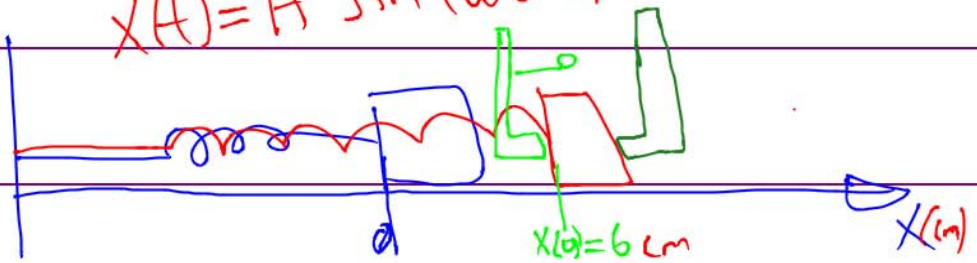
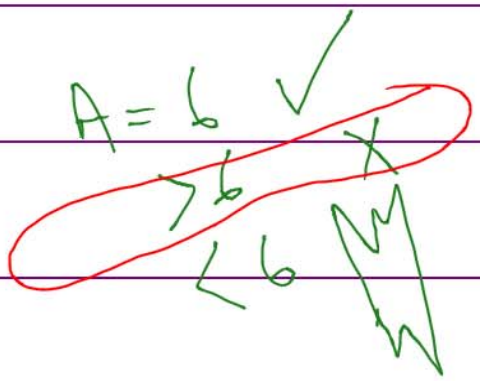
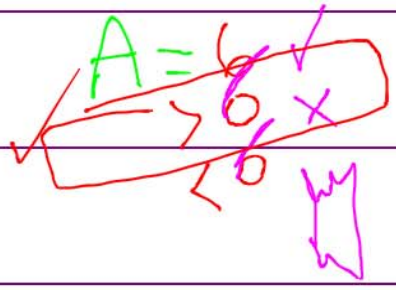
$x(t) = A \sin(\omega t + \delta)$







x_0
v_0

$F = -kx$ ... Hooke

$x(0) = ?$
$v(0) = ?$

$\frac{d^3t}{dt^3} \equiv \dddot{x}$

$\boxed{F = ma}$

$a = \frac{dv}{dt}$

$v = \frac{dx}{dt}$

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

$a = \frac{d^2x}{dt^2}$

$m\ddot{x} + \frac{k}{m}x = 0$

$\omega^2 \equiv \frac{k}{m}$

$\boxed{\ddot{x} + \omega^2 x = 0}$ ③

homogeneous 2nd order linear differential equation w/ constant coefficients

① $\dot{x} = 0 \Rightarrow x = 4$

② $\dot{x} = 4$

boundary conditions

$x(t) = A\sin(\omega t + \delta)$ ✓

initial

$x_1(t) = A$

$x_2(t) = \alpha \sin\omega t + \beta \cos\omega t$

$x_3(t) = a e^{i\omega t} + b e^{-i\omega t}$

{A, δ}
{α, β}
{a, b}

$\cos\omega t = \frac{e^{i\omega t} + e^{-i\omega t}}{2}$

$\sin\omega t = \frac{e^{i\omega t} - e^{-i\omega t}}{2i}$

$x_2(t) = 0.707 \sin 4t - 0.707 \cos 4t$

$\frac{1}{\sqrt{2}}$, $-\frac{1}{\sqrt{2}}$

$\delta = \frac{7\pi}{4}$

$x_2(t) = 1 * \sin\left(4t + \frac{3\pi}{4} + \pi\right)$

$= -\sin\left(4t + 3\pi/4\right)$

$= -\left\{ \sin 4t \left(-\frac{1}{\sqrt{2}}\right) + \cos 4t \left(1/\sqrt{2}\right) \right\}$

$= \frac{1}{\sqrt{2}} \sin 4t - \frac{1}{\sqrt{2}} \cos 4t$

$A = \sqrt{\alpha^2 + \beta^2}$, $\delta = \tan^{-1}\left(\frac{\alpha}{\beta}\right)$

$\sim A \sin$

$a, b \longleftrightarrow A, \delta$