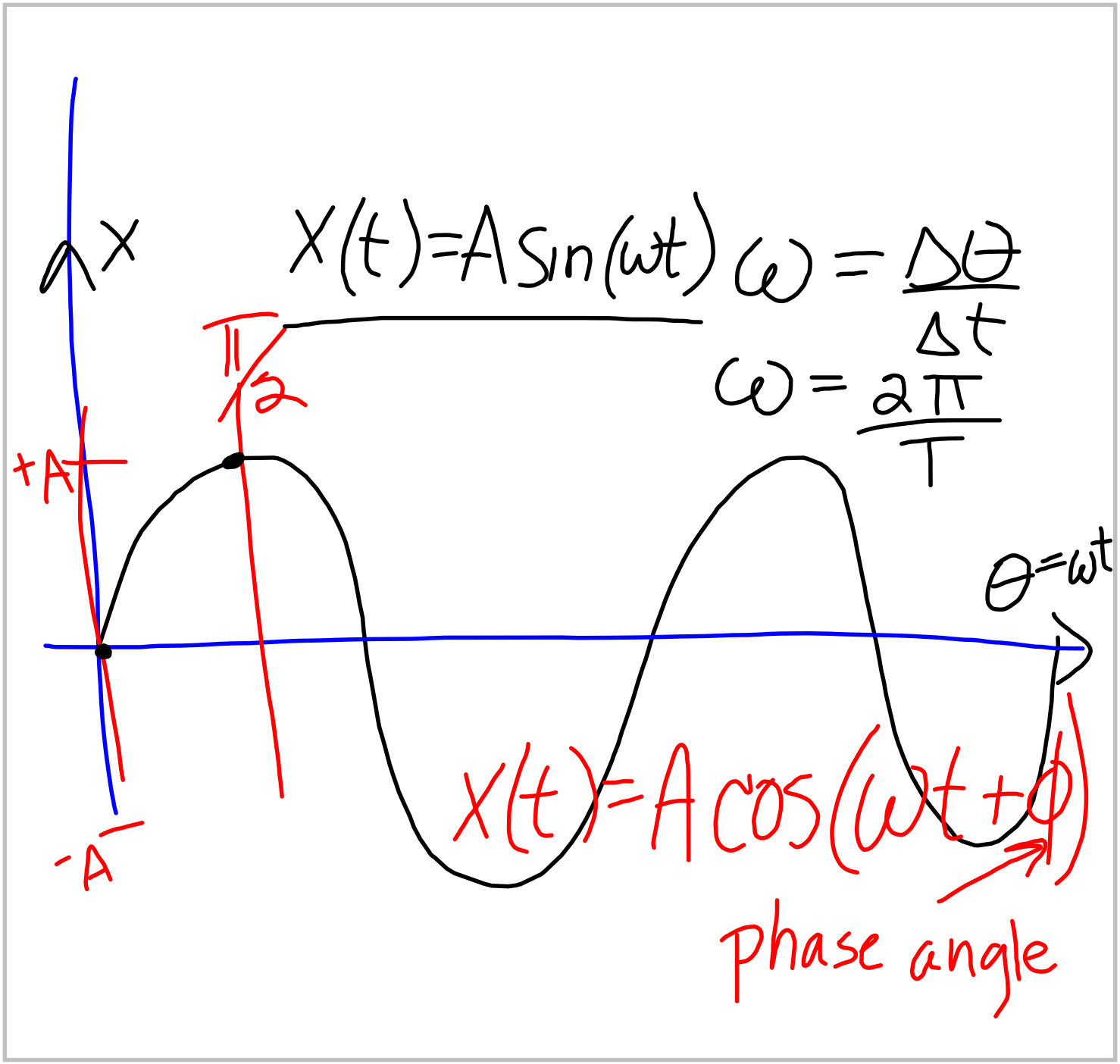
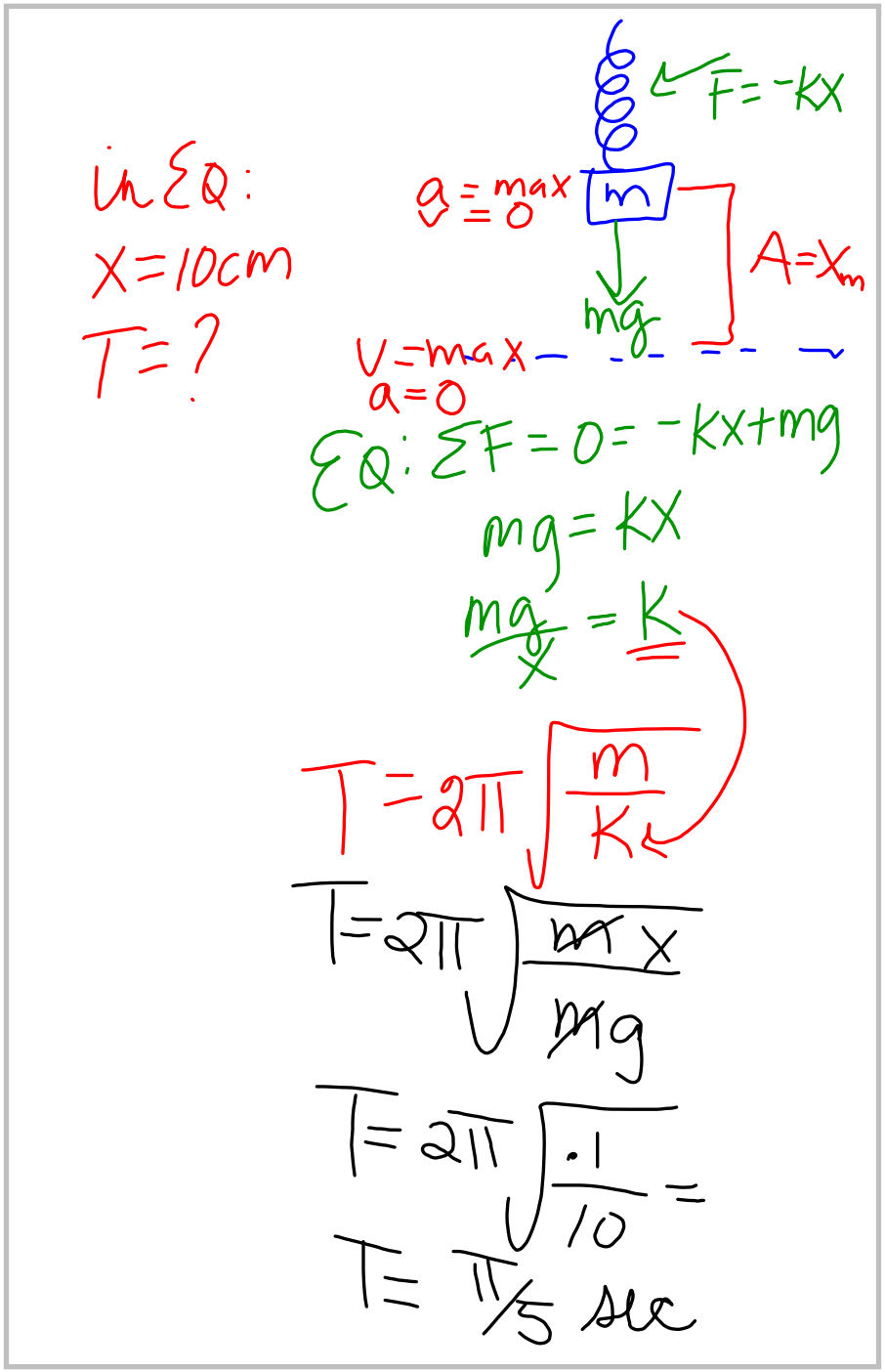

X
X(t)=A Sin(ωt)
ω = Δθ / Δt
ω = 2π / T
π/2
+A
-A
θ=ωt
X(t)=A cos(ωt+ϕ)
phase angle

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

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

$$a(t) = \frac{dv}{dt} = -\omega^2 A \cos(\omega t + \phi)$$

$$\bigstar \quad a \propto -\omega^2 x$$


in EQ:
X = 10cm
T = ?
F = -kx
a = max
m
mg
A = x_m
v = max
a = 0
EQ: ΣF = 0 = -kx + mg
mg = kx
$\frac{mg}{x} = k$
$T = 2\pi\sqrt{\frac{m}{k}}$
$T = 2\pi\sqrt{\frac{mx}{mg}}$
$T = 2\pi\sqrt{\frac{.1}{10}} =$
$T = \pi/5$ sec

$m = 50\,kg$

$k = 5\,\frac{N}{m}$

$X_0 = +5\,m$

$V_0 = +5.5\,m/s$

$\phi = ?$ phase

angular frequency (ω)

$\omega = \frac{2\pi}{T}$

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

$\omega = \sqrt{\frac{k}{m}} = \sqrt{\frac{5}{50}} = .316\,\frac{rad}{s}$

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

$X_0 = A\cos\phi$ $\quad A = \frac{X_0}{\cos\phi} = \frac{5}{\cos(-74^\circ)}$

$V_0 = -\omega A\sin(\omega t + \phi)$ $\quad A = 18.1\,m$

$V_0 = -\omega\left(\frac{X_0}{\cos\phi}\right)\sin\phi$

$\frac{V_0}{-\omega X_0} = \tan\phi$

$\frac{5.5}{-(.316)(5)} = \tan\phi$

$\phi = -74^\circ = -1.29\,rad$

$$U = \frac{1}{2} k x_m^2$$

A

$$= \frac{1}{2}(5)(18.1)^2 = 819\,\text{J}$$

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

$$x(t) = 18.1\cos(.316t - 1.29)$$

$$v(t) = -\cancel{20}\ \text{m/s}\ .316\ 18.1\ A\sin(\omega t + \phi)$$

$$v(t) = -5.72$$

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