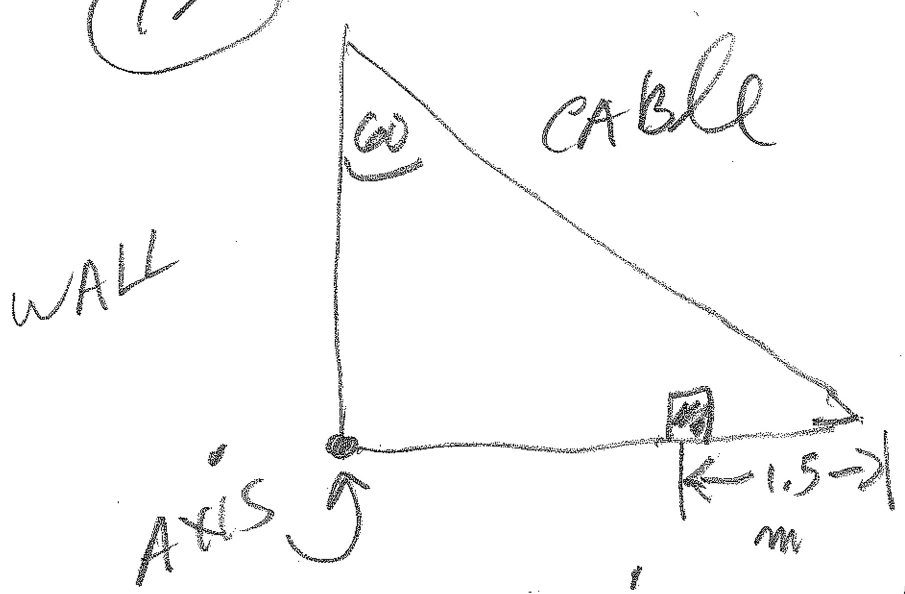
111-4-13

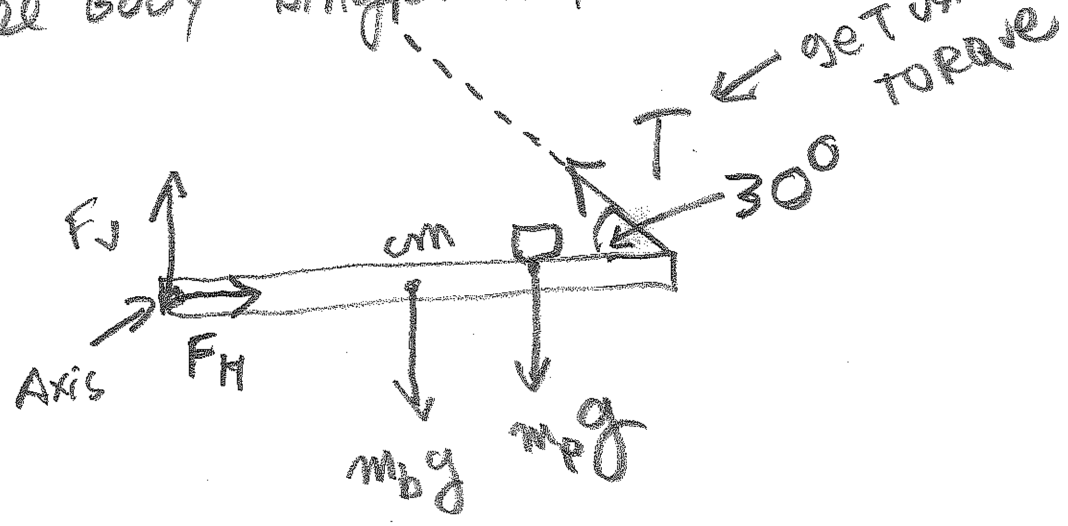
Example 10.12 - LADDER PROBLEM I DID LAST FRIDAY.

TODAY: BEAM (STATICS, CH10)

(47)



(a) FREE BODY DIAGRAM FOR beam:



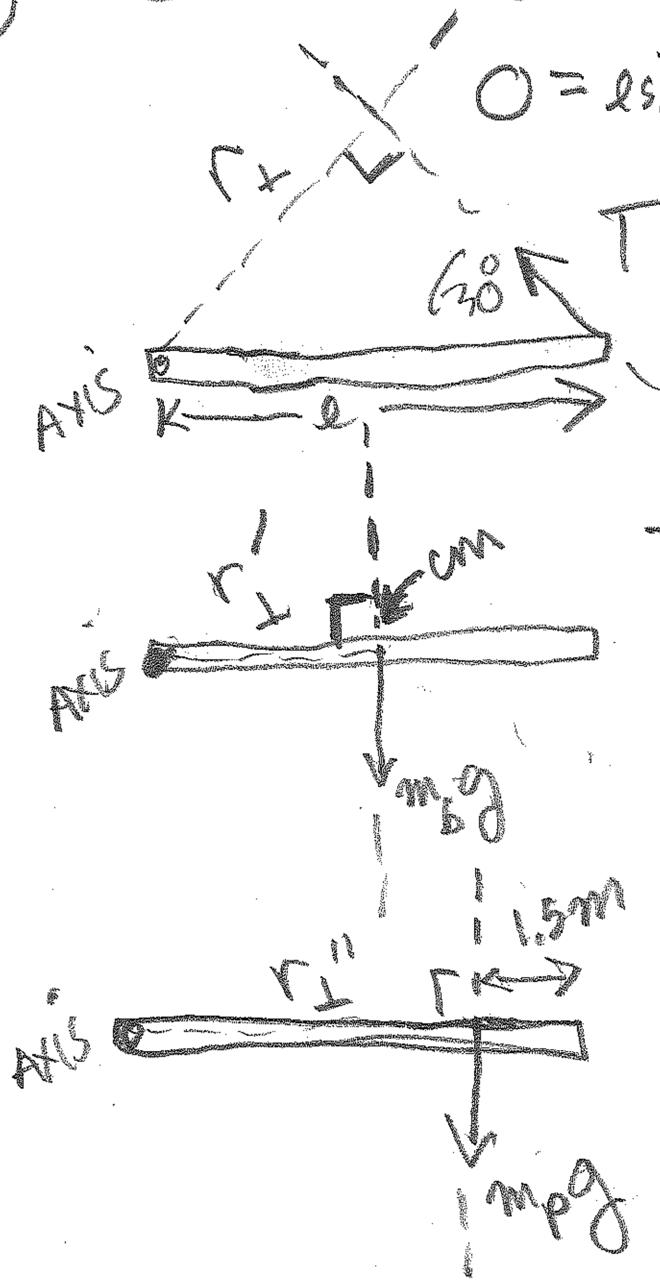
(b)

$$\sum_{Axis} \tau = ↺ - ↻$$

$$0 = ↺ - ↻ = r_\perp T - r'_\perp m_b g - r''_\perp m_p g$$

$$0 = l \sin 30\, T - \frac{l}{2} m_b g - (l-1.5) m_p g$$

$$T = \frac{\frac{l}{2} m_b g + (l-1.5) m_p g}{l \sin 30}$$



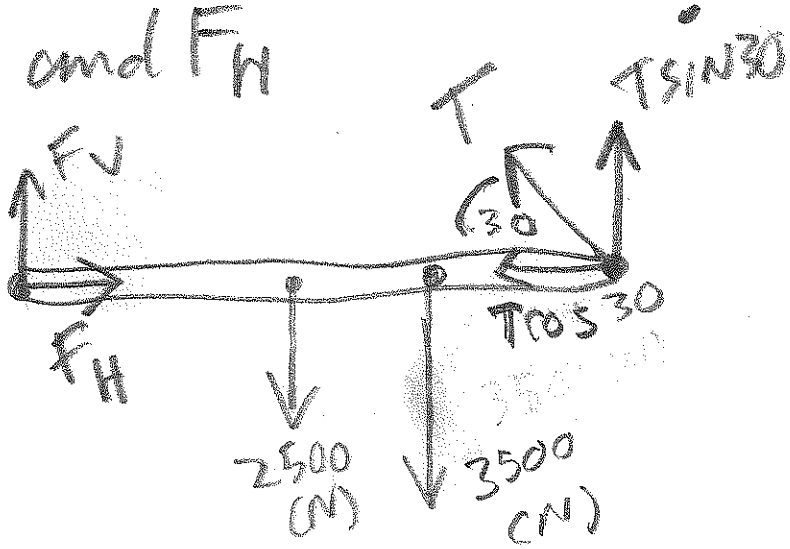
$$T = \frac{(2.0)(2500) + (4.0-1.50)(3500)}{(4.0)\cdot\frac{1}{2}}$$

$$T = \frac{5000 + (2.5)(3500)}{2}$$

$$T = \frac{5000 + 8750}{2}$$

$$T = 6875\ (N)$$

(c) need F_V and F_H



$\Sigma F_x = 0 = \text{pos} - \text{neg}$

$0 = F_H - T\cos 30$

$F_H = T\cos 30$

$= 5954\ (N)$

$$\Sigma F_y = 0 = \text{pos} - \text{neg}$$

$$0 = T\sin 30^\circ + F_V - 6000$$

$$F_V = 6000 - T\sin 30$$

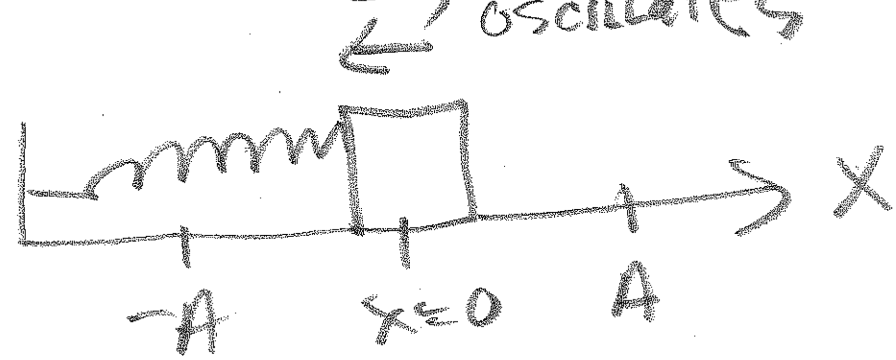
$$= 6000 - 6875 \cdot \frac{1}{2}$$

$$= 2563 (N)$$

CH11 START

we already started 11.2

see notes 10-28-13



$\frac{1}{2}kx^2 + \frac{1}{2}mv^2 = \text{constant}$

at $x = \pm A$, $KE = 0$

$x = \pm A$ are turning points.

at $x = \pm A$, $KE = 0$ and $U_s = \frac{1}{2}kA^2$

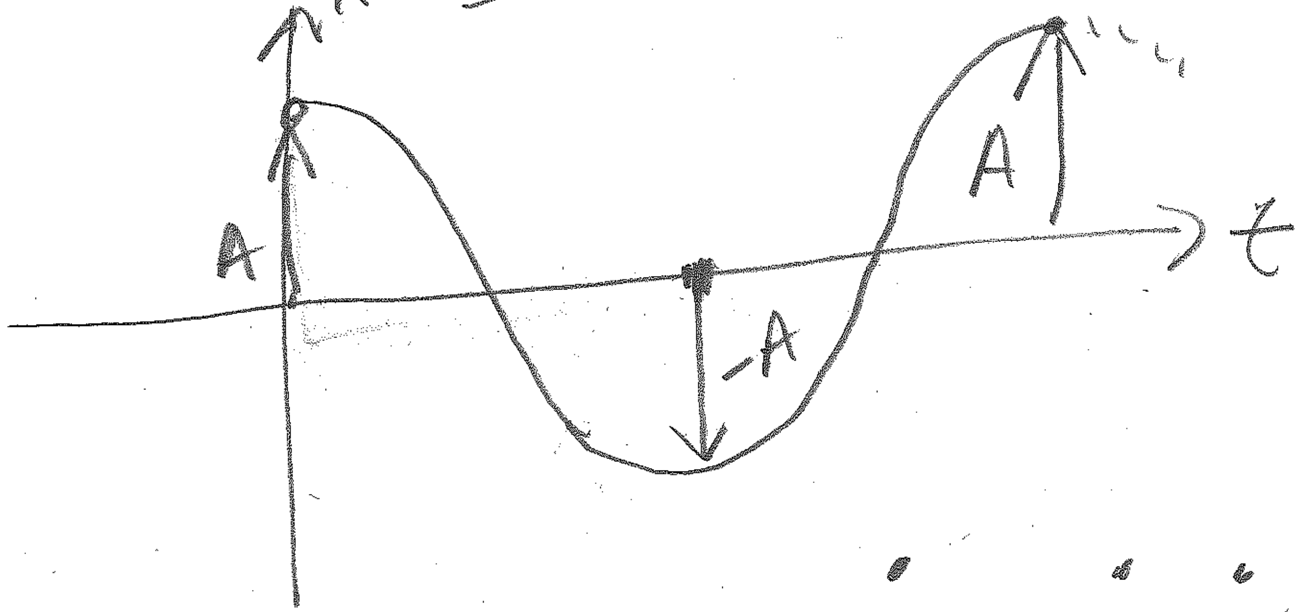
$\frac{1}{2}kx^2 + \frac{1}{2}mv^2 = \frac{1}{2}kA^2$

$\Rightarrow A = \sqrt{x^2 + \frac{m}{k}v^2}$

TYPICAL X vs. t curve

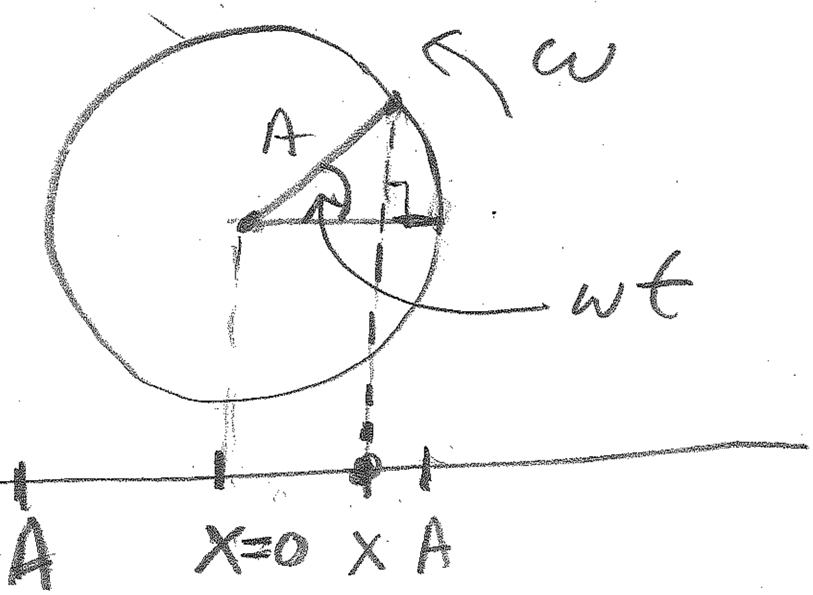
at $t=0$, KE $=0$

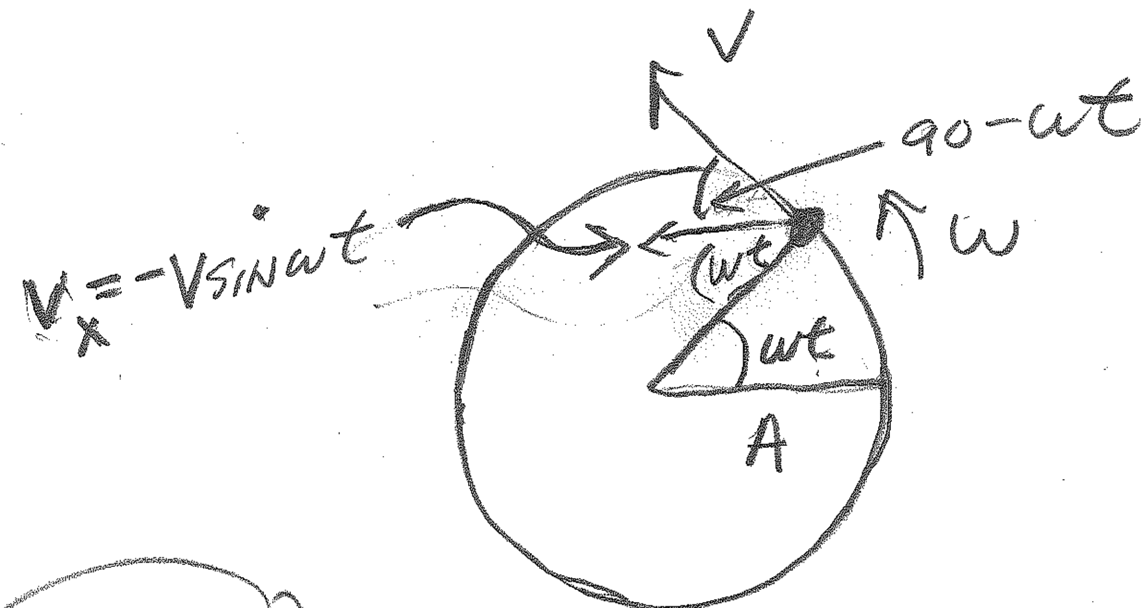
$X = A\cos\omega t$



Note: p347 simple harmonic motion in 1D is the projection of circular in 2-D.

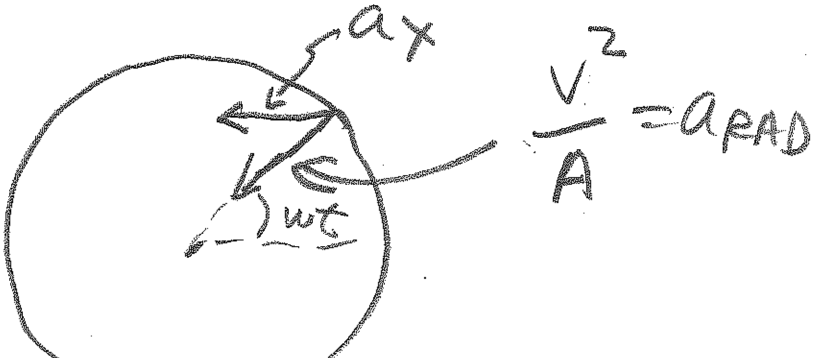
$X = A\cos\omega t$





$V = w \cdot A$

well known result (CH 9)



$$w = \frac{2\pi}{T} = 2\pi f$$

$$a_{RAD} = \frac{v^2}{A} = w^2 \cdot A$$
$$= 4\pi^2 \cdot f^2 \cdot A$$

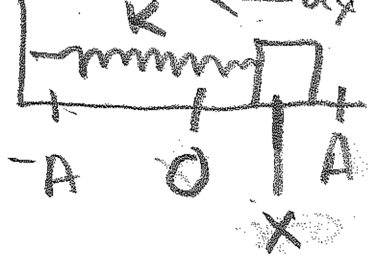
$$a_x = -\, a_{RAD} \cos wt$$

$$a_x = 4\pi^2 f^2 A \cos wt$$

ALSO

$$x = A \cos wt$$

$$v_x = -wA \sin wt$$



$$a_x = -\frac{k}{m} x \quad (11.12)$$

$$F_x = m a_x = -kx$$

$$(11.23) \quad a_x = -\omega^2 \cdot x$$

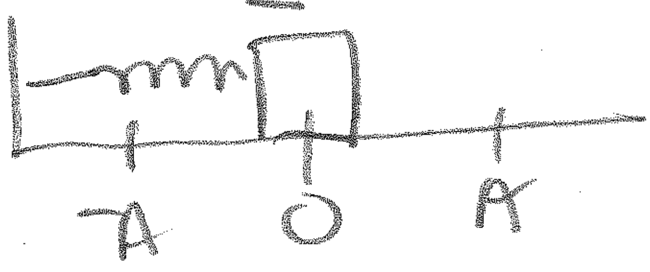
$$= -4\pi^2 f^2 \cdot (A \cos \omega t)$$

$$-\frac{k}{m} x = 4\pi^2 \cdot f^2 \cdot x$$

$$\rightarrow \quad 2\pi f = \sqrt{\frac{k}{m}}$$

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

⇄ oscillates at ω



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

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

VIDEO on PENDULUM

$$T = 2\pi\sqrt{\frac{\ell}{g}}$$