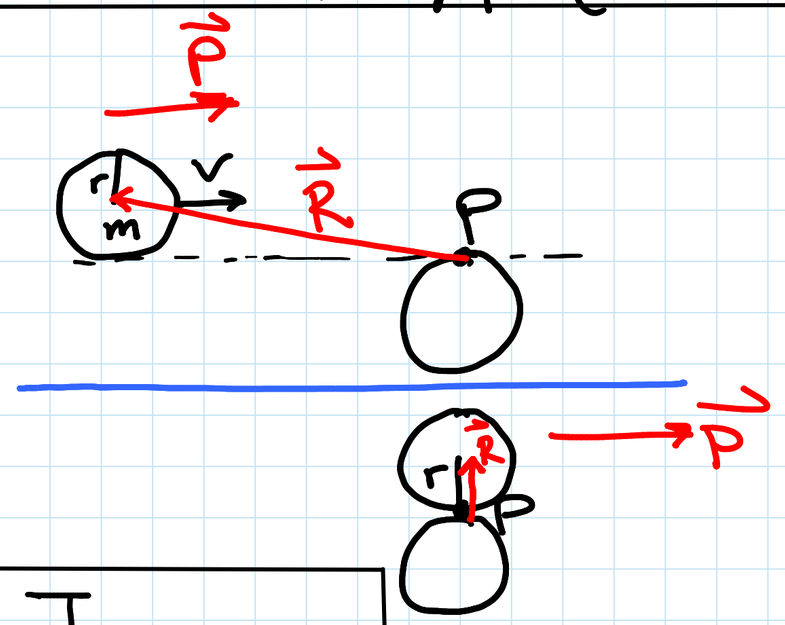
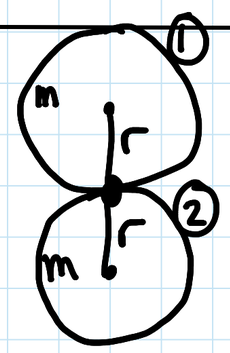
Phys 121, Fall 2021, Module 6, Long Answer Problem 3/4 (Two Pucks).

a) $\vec{L} = \vec{R} \times \vec{P}$

$= |\vec{R}||\vec{P}| \sin\theta$ (1)

$= rmv$



b) 

$I_{①,P} = I_{①,CM} + mr^2$

$= \frac{1}{2}mr^2 + mr^2$

$I_{②,P} = I_{②,CM} + mr^2$

$= \frac{1}{2}mr^2 + mr^2$

$I_P = I_{①,P} + I_{②,P} = 2\left(\frac{1}{2}mr^2 + mr^2\right) = 3mr^2$

---

c) $L_i = L_f$

$\cancel{r}mv = I\omega$

$= 3\cancel{m}r^{\cancel{2}}\omega$

$\omega = \frac{v}{3r}$

---

d) $P_i = P_f$

$\cancel{m}v = 2\cancel{m}V$

$V = \frac{v}{2}$

---

e) $\Delta K = \frac{P}{q} K_i$: P.q =?

$K_f - K_i$

$\Delta K = \frac{1}{2}(2m)V^2 + \frac{1}{2}I\omega^2 - \overbrace{\frac{1}{2}mv^2}^{K_i}$

$= m\left(\frac{v}{2}\right)^2 + \frac{1}{2}3mr^2\left(\frac{v}{3r}\right)^2 - K_i$

$= \frac{1}{4}mv^2 + \frac{3}{2}m\cancel{r^2}\frac{v^2}{9\cancel{r^2}} - K_i$

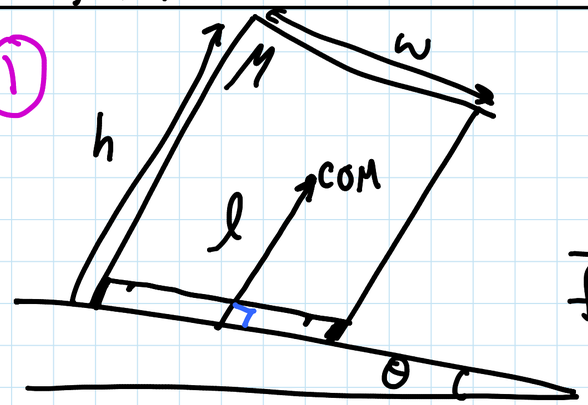
$= \frac{1}{2}K_i + \frac{3}{9}K_i - K_i$

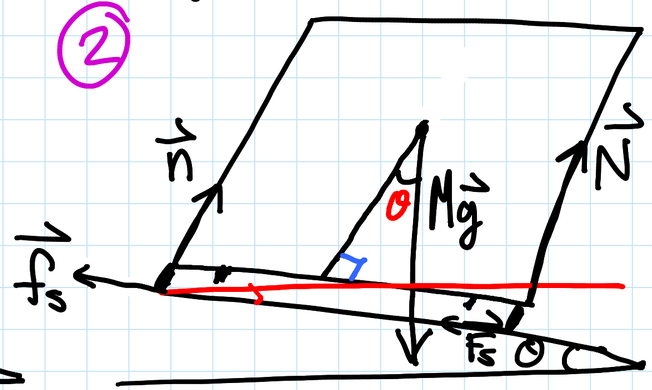
$= K_i\left[\frac{9}{18} + \frac{6}{18} - \frac{18}{18}\right]$

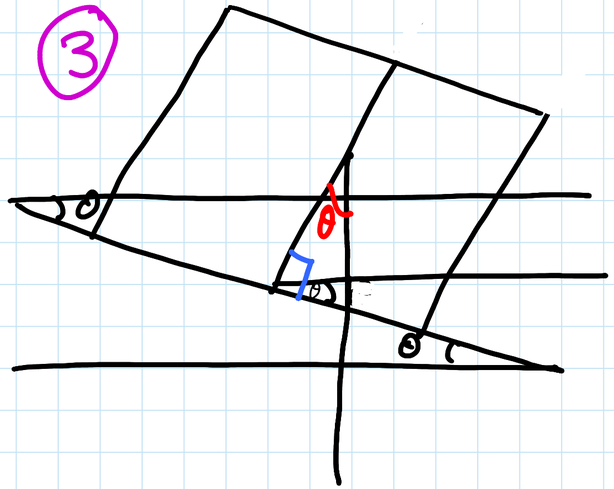
$= -\frac{1}{3}K_i$

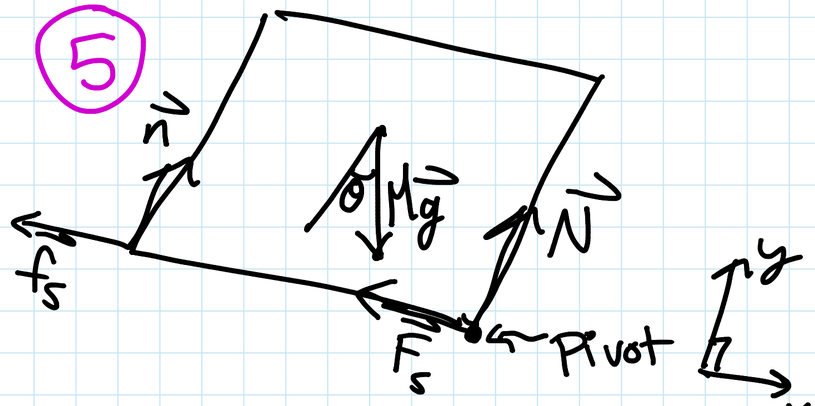
Phys 121, Fall 2021, Module 6, Long Answer, Problem 27 (Equilibrium)

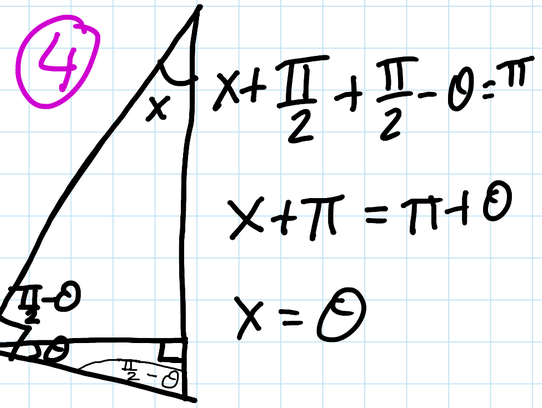
a)











$$x+\frac{\pi}{2}+\frac{\pi}{2}-\theta=\pi$$

$$x+\pi=\pi+\theta$$

$$x=\theta$$

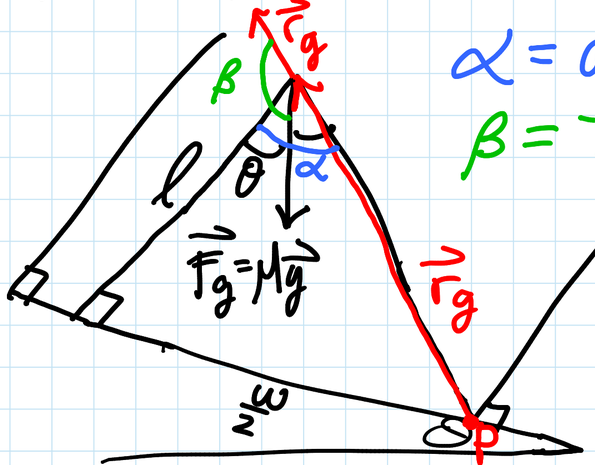
$$\sum F_x = -f_s - F_s + Mg\sin\theta = 0$$

$$\sum F_y = n + N - Mg\cos\theta = 0$$

$$\sum \tau = \vec{r}_{f_s}\times\vec{F}_{f_s} + \vec{r}_n\times\vec{F}_n + \vec{r}_g\times\vec{F}_g = 0$$

$$= w\mu_s n\sin(0) + wn\sin\left(\frac{\pi}{2}\right) + \left(\sqrt{\ell^2+\left(\frac{w}{2}\right)^2}\right)Mg\sin(\beta)$$

$\theta=0 \Rightarrow \sin(0)=0.$



$$\alpha = \arctan\left(\frac{w}{2\ell}\right)$$

$$\beta = \pi - \alpha + \theta$$