* Static equilibrium:

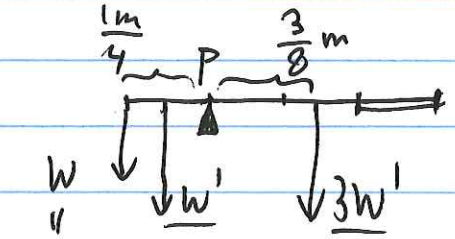
$\vec{F}_{net} = 0$ AND $\tau_{net} = 0$

↳ 2 equations ↳ 1 equation

↳ solve for unknowns forces, angles, distances

* Where do you pick the pivot point for τ_{net}?

↳ pick pivot point in a place where multiple unknown forces apply → τ for those forces will be zero around that pivot



$\tau^P_{net} = 0$

$\tau^P_{net} = \frac{1m}{4} W + \frac{1m}{8} W' - 3\frac{1m}{8} 3W' = 0$

~~$2\frac{1m}{4} W - \frac{8m}{8} W' = 0$~~

~~$W' = \frac{1}{4} W$~~

$\tau^P_{net} = \frac{1}{4} W + \frac{1}{8} W' - \frac{9}{8} W' = 0$

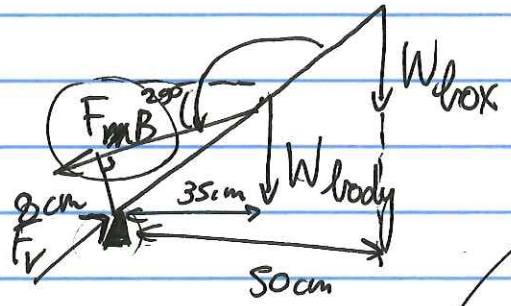
$= \frac{1}{4} W - \frac{8}{8} W' = \frac{1}{4} W - W' = 0$

$W' = \frac{1}{4} W$

$W_{stick} = 4W' = W_{rock}$

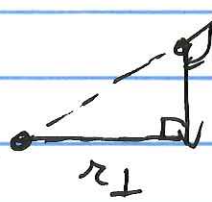
$m_{stick} = 1\,kg$

Lift with your back



$\tau_{net} = 0$ AND $\vec{F}_{net} = 0$

↳ $-W_{box}(50cm) - W_{body}(35cm) + F_B(8cm) = 0$



$\tau = r_\perp F$

$F_B = \underline{4200\,N}$ → weight of 800 lbs

MA = mechanical advantage = $\frac{F_{out}}{F_{in}} = \frac{W_{box} + W_{body}}{F_B}$

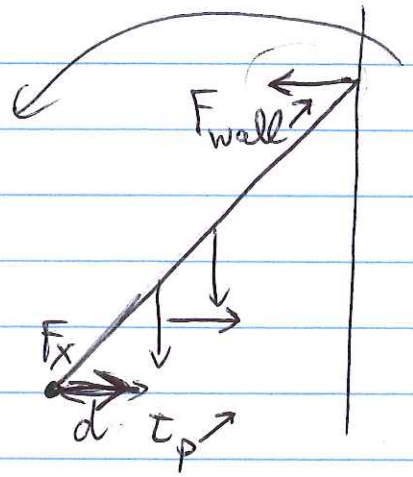
$\approx \frac{1}{5} = 20\%$

$F_{net,x} = 0 = -F_B \cos 29° + F_{V,x} \rightarrow F_{V,x} = 3670N$

$F_{net,y} = 0 = -F_B \sin 29° - W_{box} - W_{body} \rightarrow F_{V,y} = 2870N$

↳ $F_V = \sqrt{F_{V,x}^2 + F_{V,y}^2} = \underline{4660N}$

$\theta = \tan^{-1}\left(\frac{F_{V,y}}{F_{V,x}}\right) = 38°$

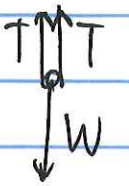


$\tau_{net} = 0$

$\vec{F}_{net} = 0 \rightarrow F_{net,x} = 0$

$F_x \nearrow$

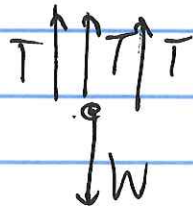
Mechanical advantage: $\frac{F_{out}}{F_{in}}$

FBD: 

$\vec{F}_{net} = 0 = 2T - W = 0$

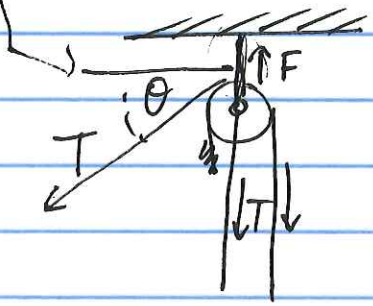
$T = \frac{W}{2}$

$MA = \frac{F_{out}}{F_{in}} = \frac{W}{T} = \frac{W}{W/2} = 2$

FBD: 

$F_{net} = 3T - W \rightarrow T = \frac{W}{3}$

$MA = \frac{W}{T} = \frac{W}{W/3} = \underline{3}$



$F_{net} = F - 2T - T\sin\theta = 0$

$F = \underbrace{2T + T\sin\theta}_{W}$

* NetFlix in System:

$$\tau_{net} = 0 \quad \text{AND} \quad \vec{F}_{net} = 0$$

$$\begin{cases} F_{net,x} = 0 = -F_V \cos\theta + F_m \cos 33^\circ = 0 \\ F_{net,y} = 0 = F_V \sin\theta - W_{head} - F_m \sin 33^\circ = 0 \end{cases}$$

$$\begin{cases} F_V \cos\theta = F_m \cos 33^\circ \\ F_V \sin\theta = W_{head} + F_m \sin 33^\circ \end{cases}$$

$$(F_V \cos\theta)^2 + (F_V \sin\theta)^2 = F_V^2 (\cos^2\theta + \sin^2\theta)$$

$$= 1$$

$$F_V = 97\ N$$