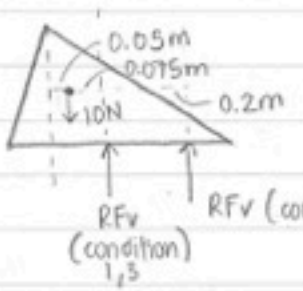
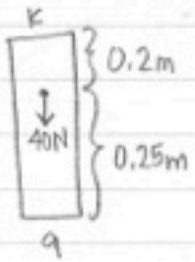
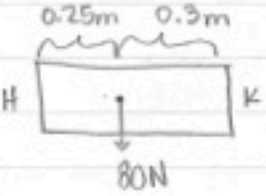
(10-9)

^going to use established parameters to really practice segmental FBDs in reality

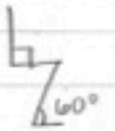
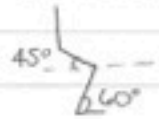




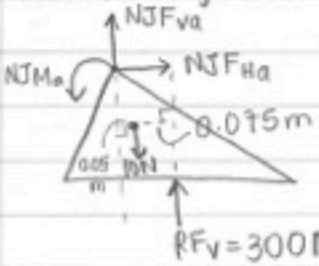


RFv = 300 N

- working through these conditions to practice w/ real values

condition 1	condition 2	condition 3	condition 4
			
(90°, 90°, 90°)	(90°, 60°)	(90°, 45°)	(45°, 60°)
COP = 0.075m	COP = 0.2m	COP = 0.075m	COP = 0.2m

(condition 1, foot)



$\Rightarrow$ $\Sigma F_H = ma_H^{\circ 0} \rightarrow 0 = NJF_{Ha} \rightarrow$ no horizontal force

$\Sigma F_V = ma_V^{\circ 0} \rightarrow 0 = W_f + RF_V + NJF_{Va}$

$NJF_{Va} = -(300N) + (+10N)$

$\boxed{NJF_{Va} = -290\,N}$

$\Sigma M_{CM} = I_{cm}\alpha^{\circ 0}$

$0 = NJM_a + (NJF_{Va} \cdot ld) + (RF_V \cdot ld)$

$-NJM_a = (290\,N \cdot 0.05m) + (300\,N \cdot 0.075m)$

$= 14.5\,Nm + 22.5\,Nm$

$\boxed{NJM_a = -37\,Nm}$

we need to determine the ld sign, depends on CW, or CCW, the force is just magnitude

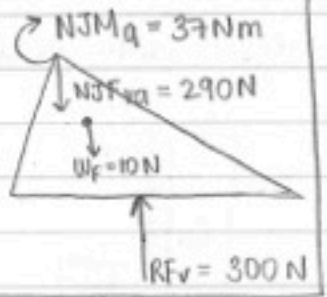
↳ to do this you need to understand the forces position in comparison to the CM ⇒ so you can determine rotation

- with condition 1, 3 the foot FBDs are the same
  ↳ in reality drawings

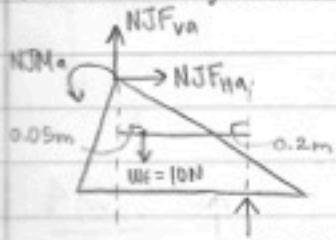
in reality FBDs (conditions 1 & 3)

↓

our assumptions for NJM_a, NJF_{va}, NJF_{ha} were all incorrect



(condition 2, foot)



$\Rightarrow$ $\Sigma F_H = ma_H^{=0} \rightarrow NJF_{ha} = 0 \rightarrow$ **no H force**

$\Sigma F_V = ma_V^{=0} \rightarrow 0 = NJF_{va} + RF_V + Wf$

$NJF_{va} = -(300N) + 10N$

$\boxed{NJF_{va} = -290N}$

$\Sigma M_{CM} = I_{cm}\alpha^{=0} \rightarrow 0 = NJM_a + (\perp d \cdot RF_V) + (\perp d \cdot NJF_{va})$

(+) (+)

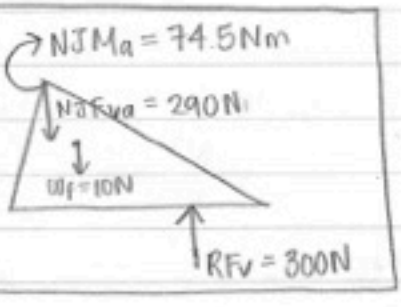
$NJM_a = -(0.2m \cdot 300N) - (0.05m \cdot 290N)$

$= -60Nm - 14.5Nm$

$\boxed{NJM_a = -74.5Nm}$

↳ Condition 2 and 4 = the same FBD for the foot

in reality FBDs (conditions 2 & 4)



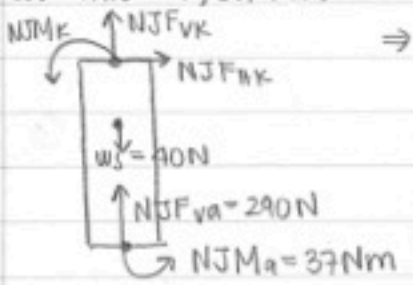
↳ <u>important</u>: compare conditions 1/3 and 2/4 $\Rightarrow$ 1 and 3 the $\perp d$ from the COP is 0.075, for 2 and 4 the $\perp d$ from the COP is 0.2m

↳ the COP distance is doubled, therefore a multiplier of the moment

↳ moment arms are multipliers

↳ (0.2m) $\rightarrow$ −74.5Nm vs. (0.075m) $\rightarrow$ −37Nm

(condition 1, shank)



$\Rightarrow$ $\Sigma F_H = ma_H^{=0} \rightarrow NJF_{HK} = 0 \rightarrow$ **no H Force**

$\Sigma F_V = ma_V^{=0} \rightarrow 0 = W_S + NJF_{Va} + NJF_{VK}$

$NJF_{VK} = -W_S - NJF_{Va}$

$= +(40N) - (290N)$

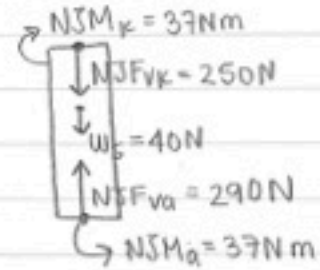
$\boxed{NJF_{VK} = -250N}$

$\Sigma M_{CM} = I_{CM}\alpha^{=0} \rightarrow 0 = NJM_K + NJM_a$ (+, CCW)

$NJM_K = -(NJM_a)$

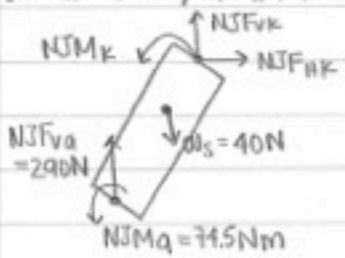
$\boxed{NJM_K = -37Nm}$

in reality FBD (Condition 1 & 3)



→ conditions 1 and 3 are the same again for the shank + no Moments from V Forces because in line with CMs

(condition 2, shank)



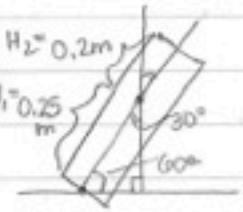
$\Sigma F_H = ma_H^{=0} \rightarrow 0 = NJF_{HK} \rightarrow$ **no H force**

$\Sigma F_V = ma_V^{=0} \rightarrow 0 = NJF_{VK} + NJF_{Va} + W_S$

$NJF_{VK} = -NJF_{Va} - W_S$

$= -290N + 40N$

$\boxed{NJF_{VK} = -250N}$



$\Sigma M_{CM} = I_{CM}\alpha^{=0} \rightarrow$

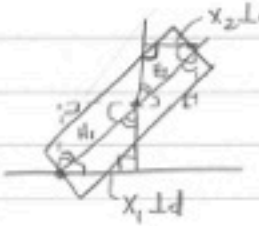
$0 = NJM_K + NJM_a + (NJF_{Va} \cdot ld) + (NJF_{VK} \cdot ld)$

$-NJM_K = +74.5Nm - (290N \cdot \sin 30° \cdot 0.25m)$

$-(250N \cdot \sin 30° \cdot 0.2m)$

$NJM_K = -74.5Nm + 36.25Nm + 25Nm$

$\boxed{NJM_K = -13.25Nm}$



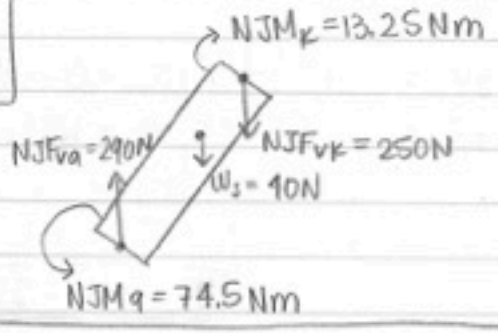
$X_1 \Rightarrow \sin 30° = \frac{ld}{H_1}$

$X_1 = \sin 30°(0.25m)$

$X_2 \Rightarrow \sin 30° = ld/H_2 \rightarrow ld\ X_2 = \sin 30°(0.2m)$

→ same results for condition 4

in reality FBD
(for conditions 2 & 4)



- will finish the thigh FBDs in class on Wednesday