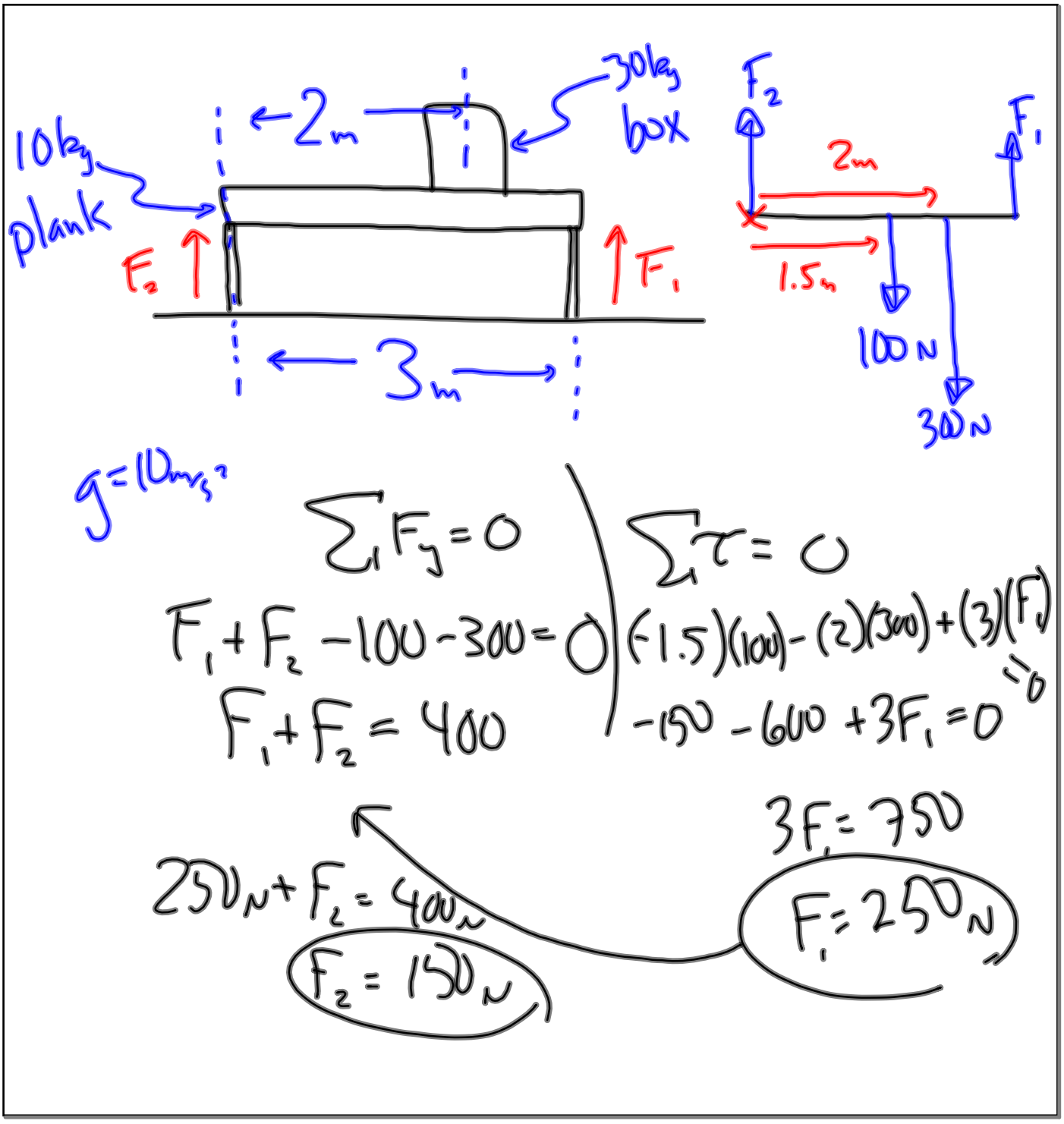
Conditions for Static Equilibrium

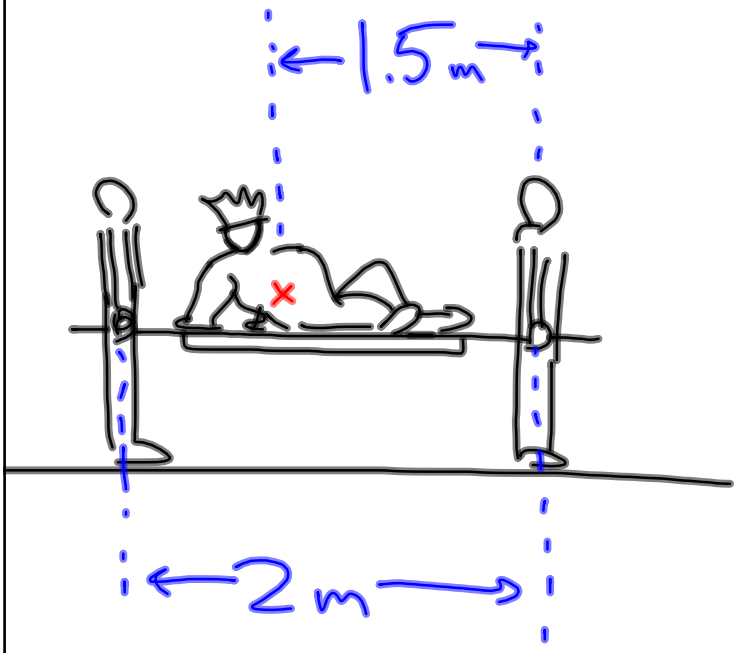
$\Sigma F = 0$	$\Sigma \tau = 0$
in all directions	**for any pivot**

If it's not in equilibrium...

$\Sigma F = ma$	$\Sigma \tau = I\alpha$

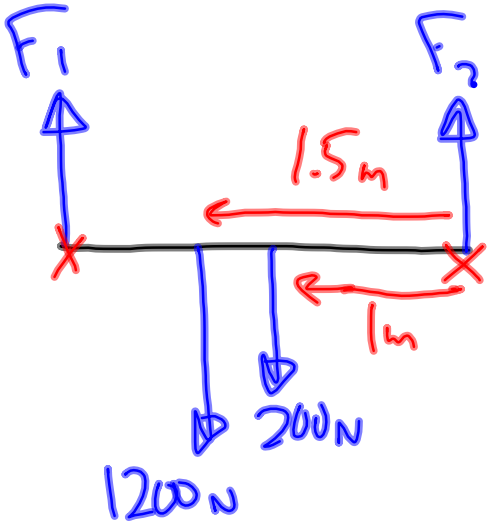

10kg
plank
2m
30kg
box
F_2
F_1
3m
F_2
F_1
2m
1.5m
100 N
300 N
$g = 10 m/s^2$
$\sum F_y = 0$
$F_1 + F_2 - 100 - 300 = 0$
$F_1 + F_2 = 400$
$\sum \tau = 0$
$(-1.5)(100) - (2)(300) + (3)(F_1) = 0$
$-150 - 600 + 3F_1 = 0$
$3F_1 = 750$
$F_1 = 250 N$
$250 N + F_2 = 400 N$
$F_2 = 150 N$

Mass of King: 120 kg
Mass of litter: 20kg



$g = 10\ m/s^2$

$-(0.5)1200 - (1)200 + 2F_2 = 0$



$\sum F_y = 0$

$F_1 + F_2 = 1400\ N$

$\sum \tau = 0$

$-(2)F_1 + (1.5)1200 + (1)(200) = 0$

$-2F_1 + 1800 + 200 = 0$

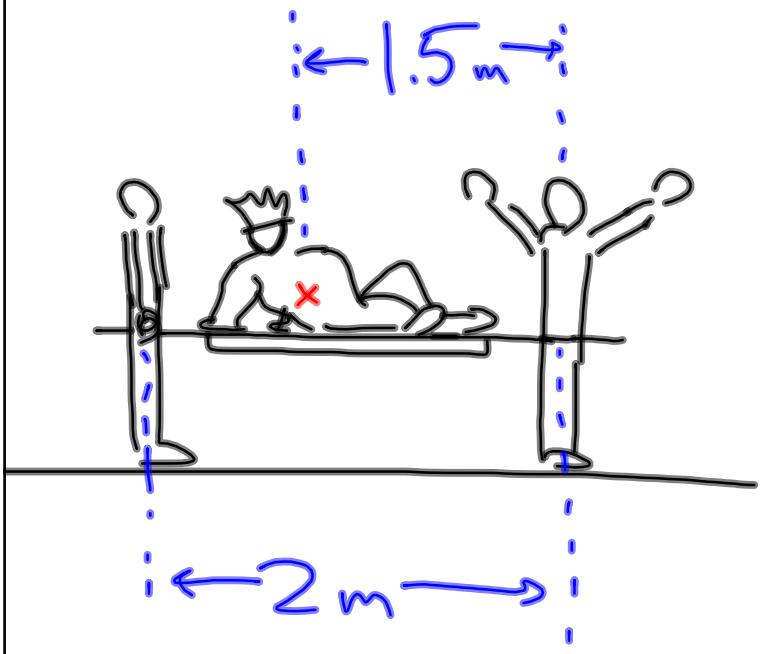
$-2F_1 = -2000$

$F_1 = 1000\ N$

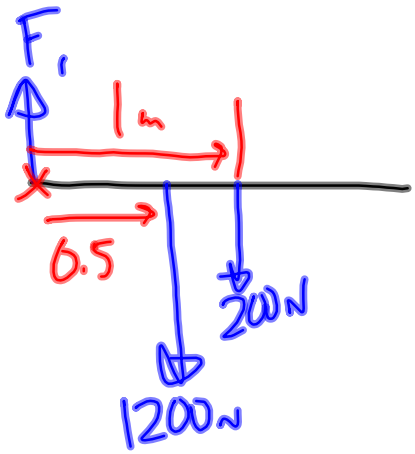
$1000 + F_2 = 1400$

$F_2 = 400\ N$

Mass of King: 120 kg
Mass of litter: 20 kg



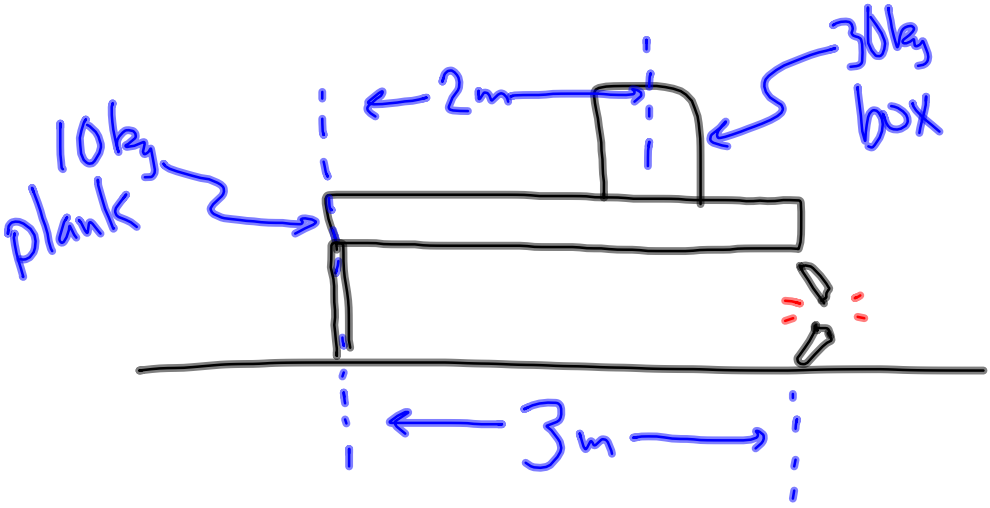
$$\sum \tau = I\alpha$$



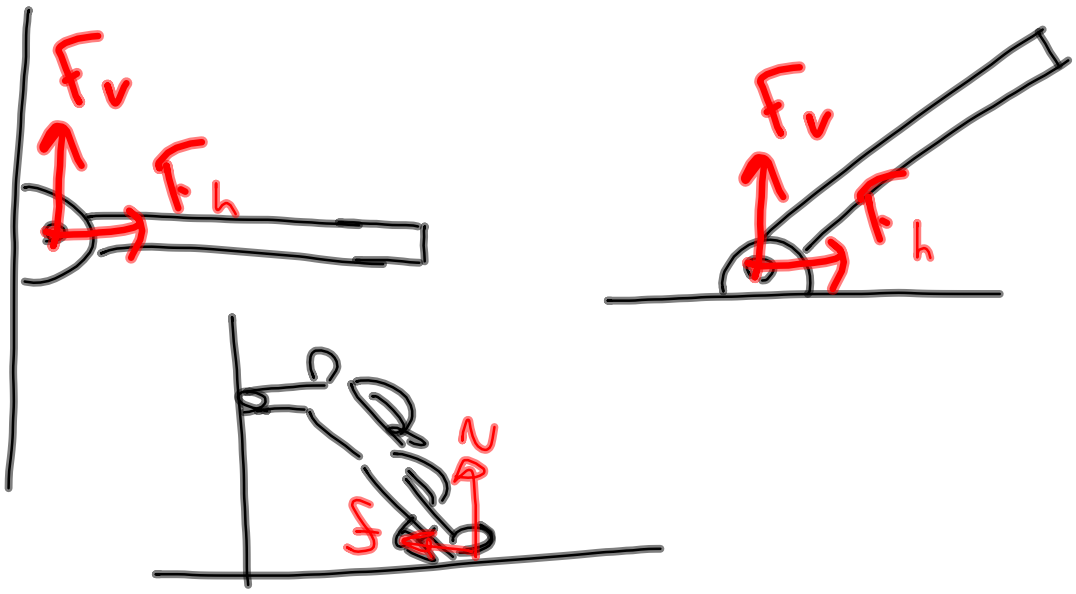
$$-(0.5)1200 - (1)(200) = I\alpha$$

$$-600 - 200 = I\alpha$$

$$-800 = I\alpha$$


10kg
plank
2m
30kg
box
3m

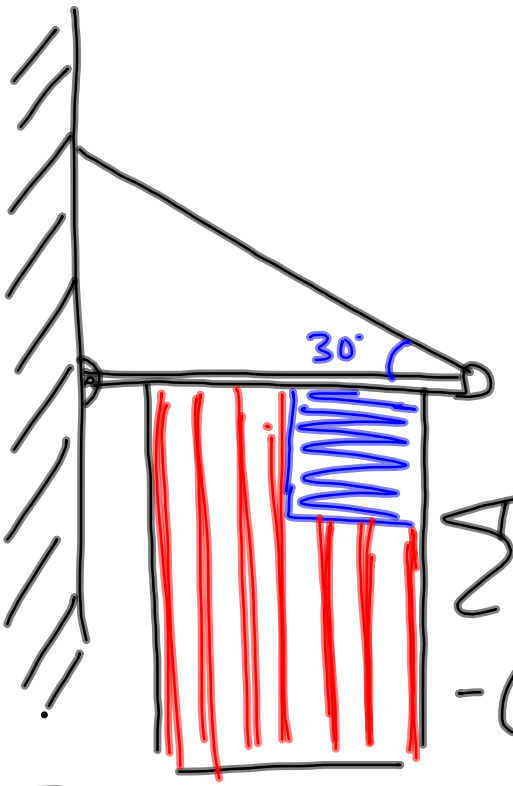
Hinges & Points of Support



At hinges:

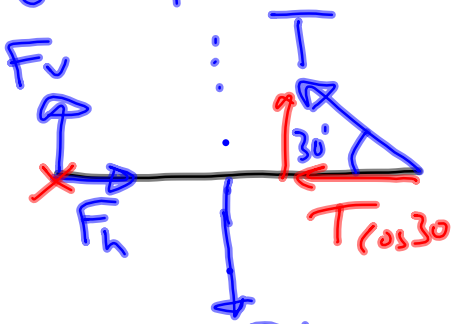
Force horizontal

Force vertical



Mass of flag and pole: 2kg

Length of pole: 1 m



$\sum \tau = 0$

$-(0.5)(20N) + (1)T\sin 30 = 0$

$\sum F_x = 0$ $\quad$ $\sum F_y = 0$

$F_h - T\cos 30 = 0$ $\quad$ $F_v + T\sin 30 - 20 = 0$

$-10 + 0.5T = 0$

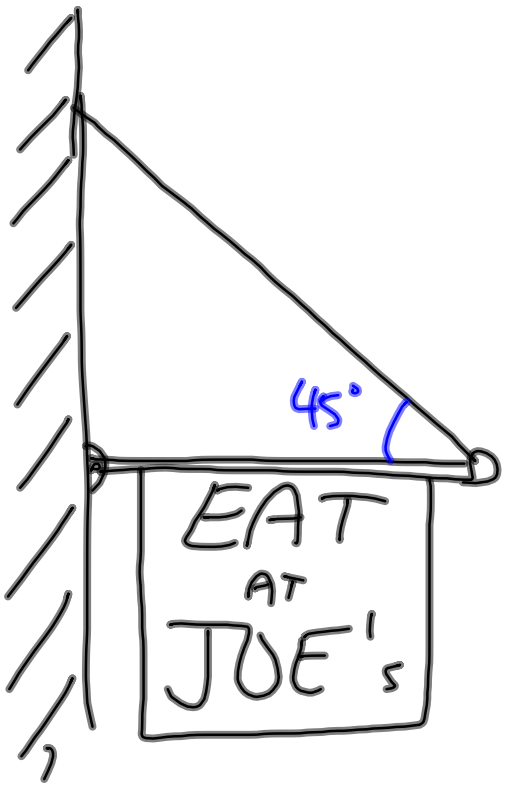
$0.5T = 10$

$T = 20N$

$F_v + 20\sin 30 - 20 = 0$

$F_v + 10 - 20 = 0$

$F_v - 10 = 0$ $\quad F_v = 10N$



Mass of pole + sign: 40 kg

length of pole: 1.6 m

T = 280ish N

Fv = 200 N

Fh = 200 N

$\sum \tau = I\alpha$

$\alpha = 16 \text{ rad/s}^2$

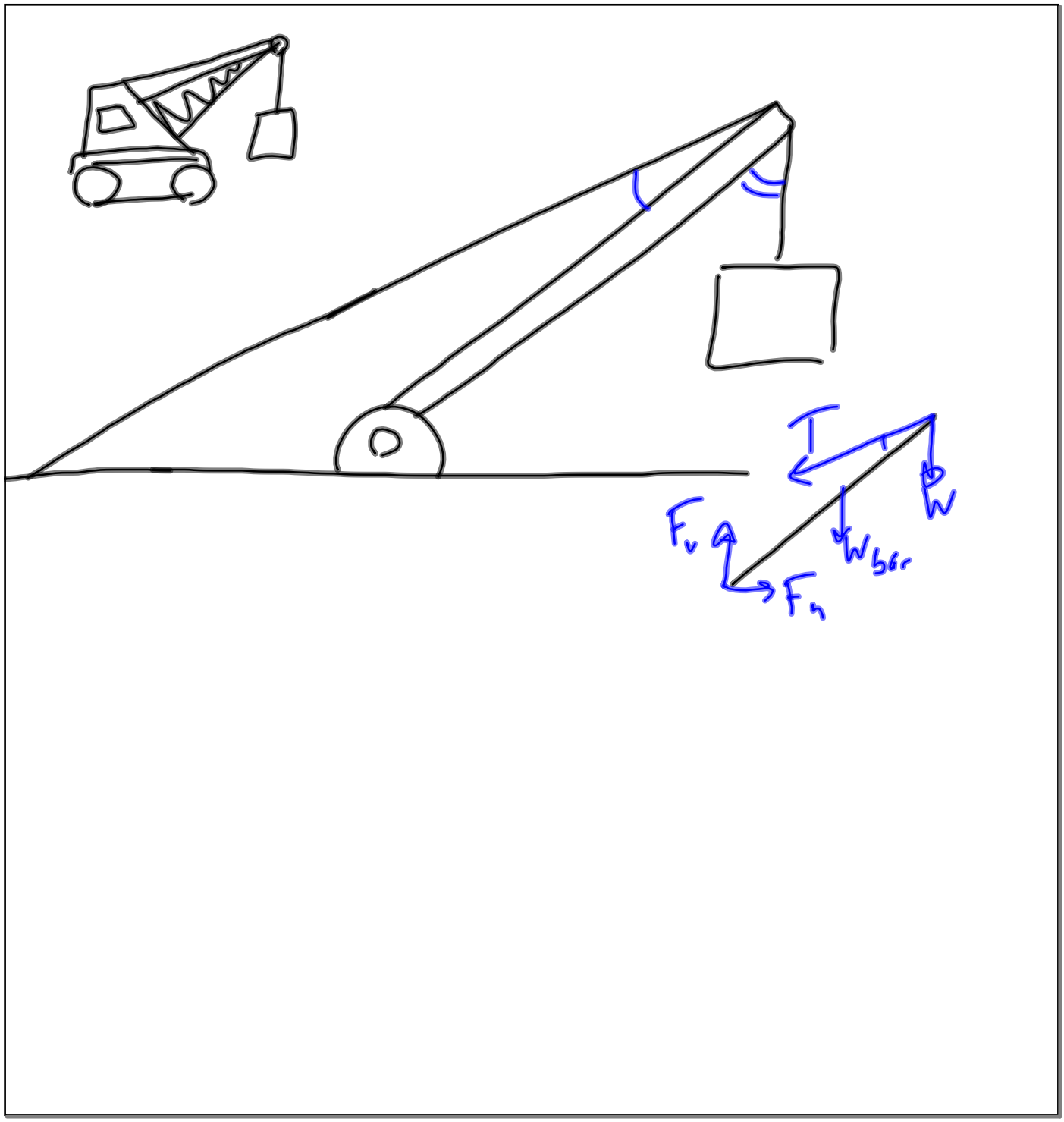
Mass of pole + sign: 40 kg

Length of pole: 1.6 m

Find the angular acceleration of the pole. Assume the rotational inertia of the sign and pole is 20 kgm^2

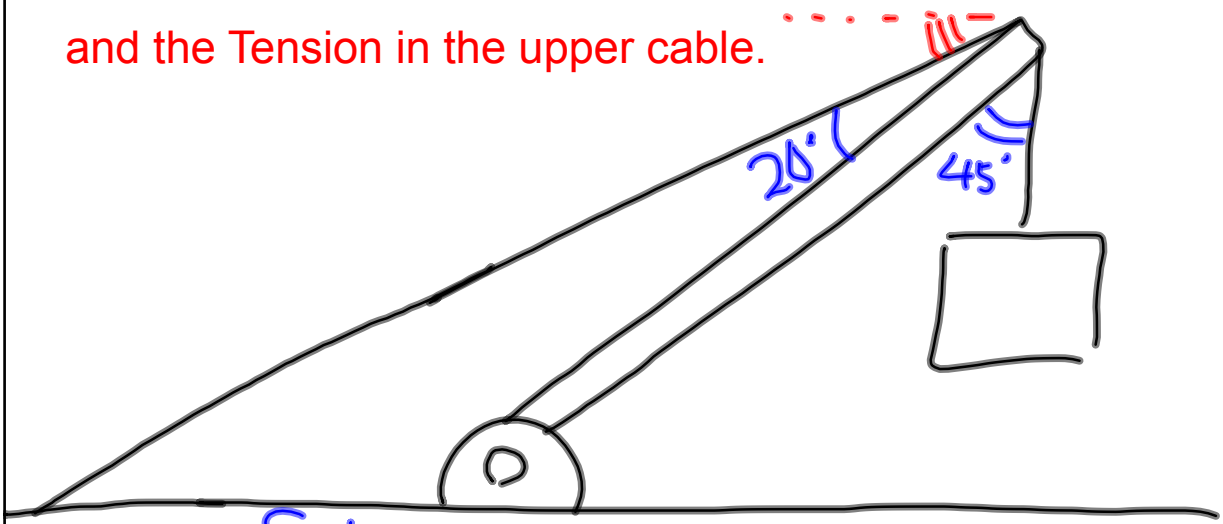
Find tangential acceleration at the tip of the pole.

$a_{tip} = 25.6 \text{ m/s}^2$


T
W
W_{56}
F_v
F_h

Find the forces at the hinge,

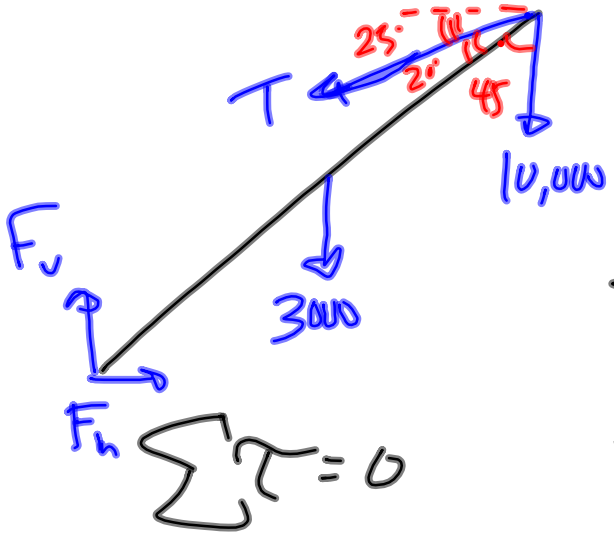
and the Tension in the upper cable.



mass of boom: 300kg

mass of load: 1000kg

length of boom: 10 m



$$\sum F_x = 0$$

$$F_h - T\cos 25 = 0$$

$$\sum F_y = 0$$

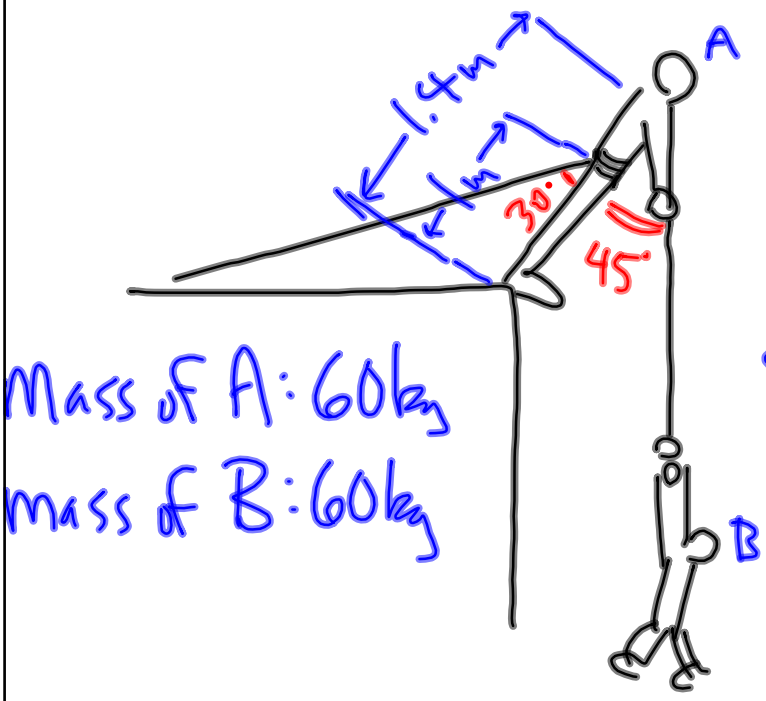
$$F_v - T\sin 25 - 3{,}000 - 10{,}000 = 0$$

$$\sum \tau = 0$$

$$-(5)(3000)\sin 45 - (10)(10{,}000)\sin 45 + (10)T\sin 20^\circ = 0$$

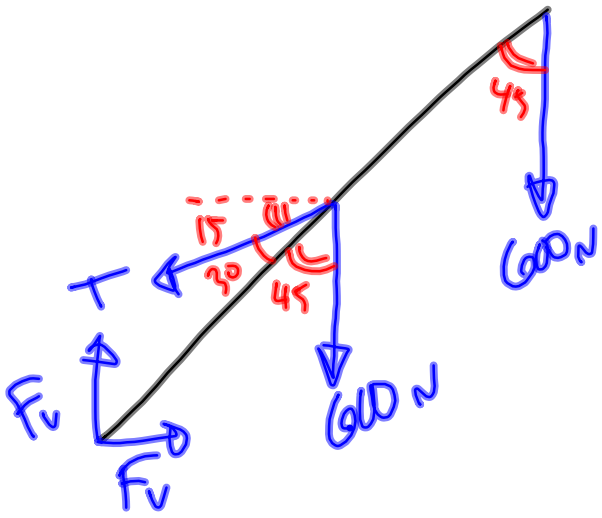
Find the forces at the person's feet,

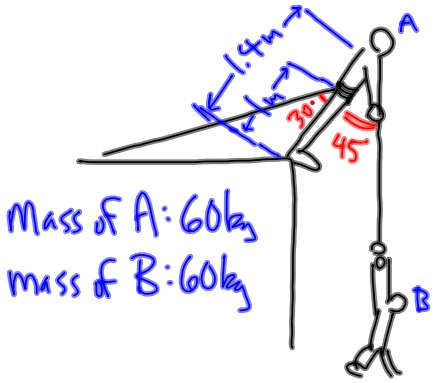
and the Tension in the horizontal rope.

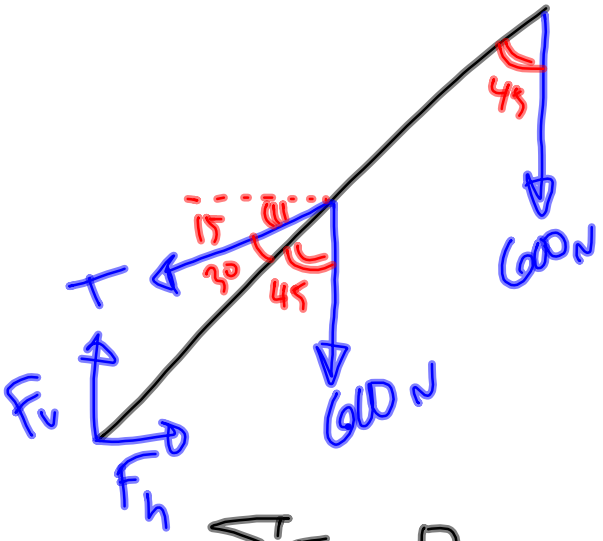


Mass of A: 60kg

Mass of B: 60kg







$$\sum F_x = 0$$

$$F_v - T\cos 15 = 0$$

$$\sum F_y = 0$$

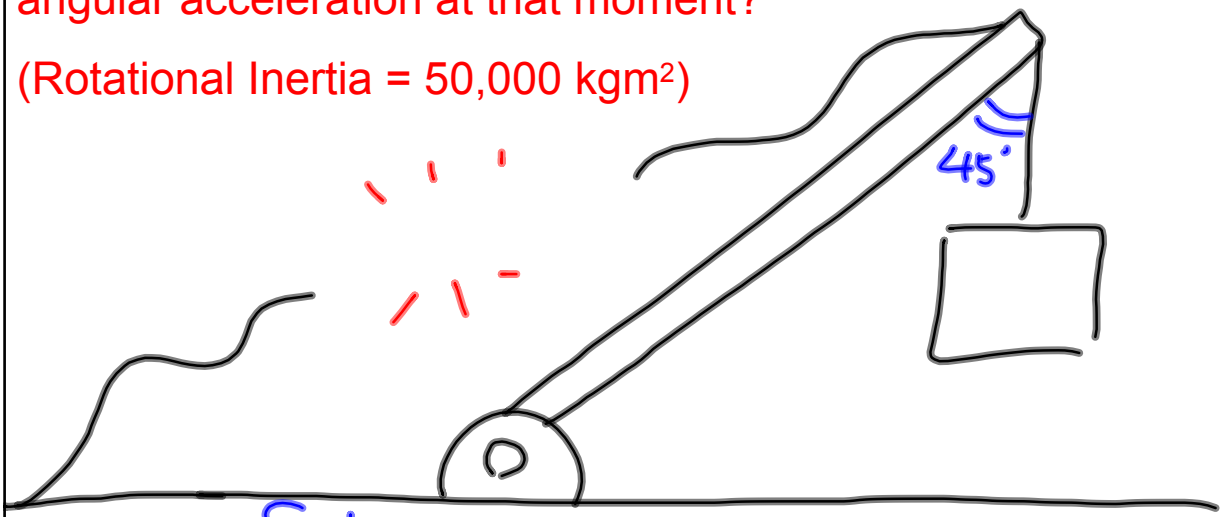
$$F_v - 600 - 600 - T\sin 15 = 0$$

$$\sum \tau = 0$$

$$(1)T\sin 30 - (1)(60)\sin 45 - (1.4)(60)\sin 45 = 0$$

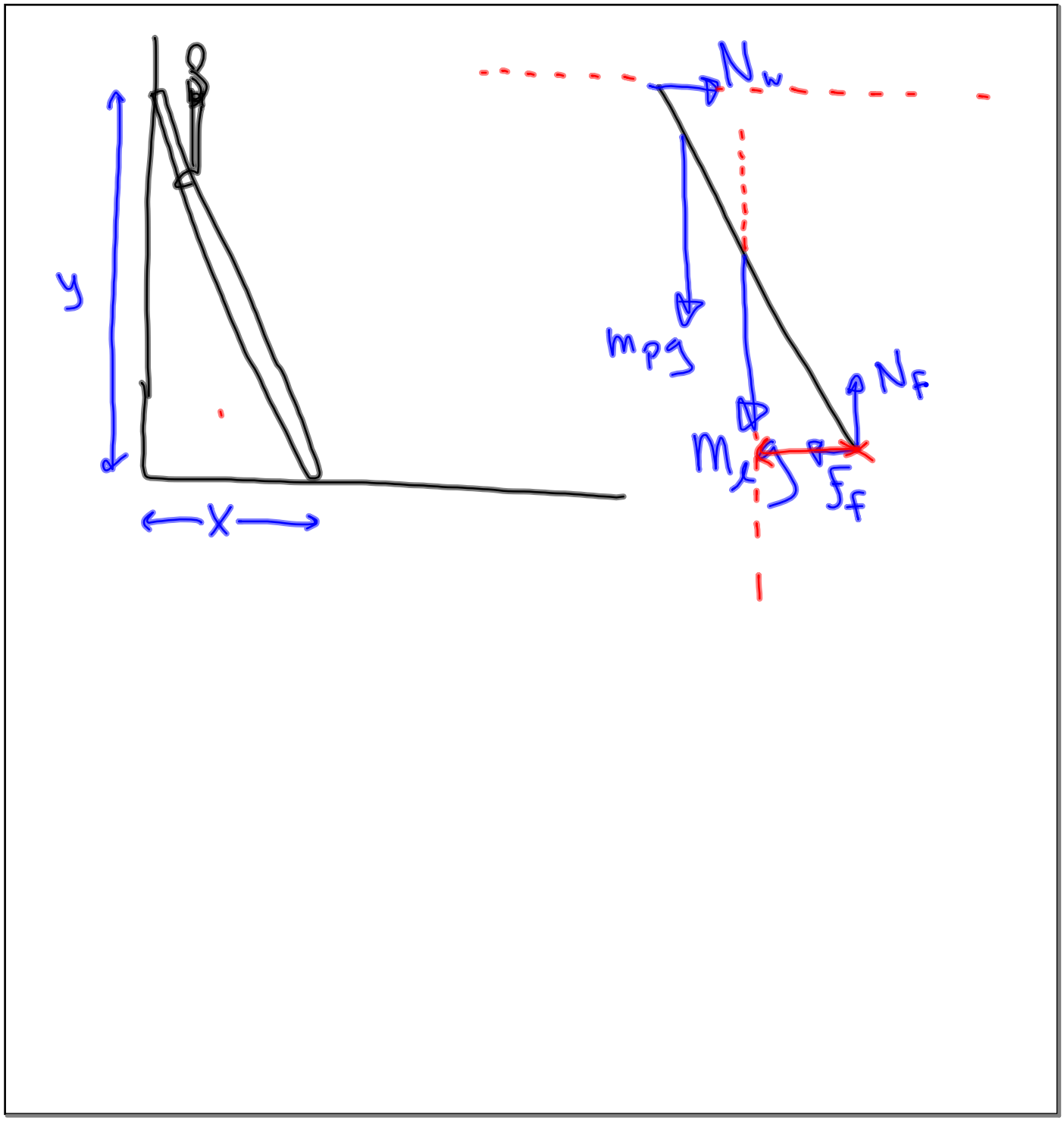
If the upper cable snaps, what is the angular acceleration at that moment?

(Rotational Inertia = 50,000 kgm^2)



mass of boom: 300kg
mass of load: 1000kg
length of boom: 10 m

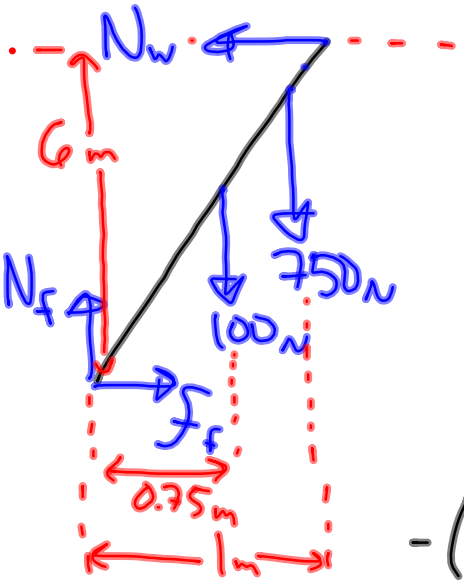
$\alpha = 1.6$ rad/s^2

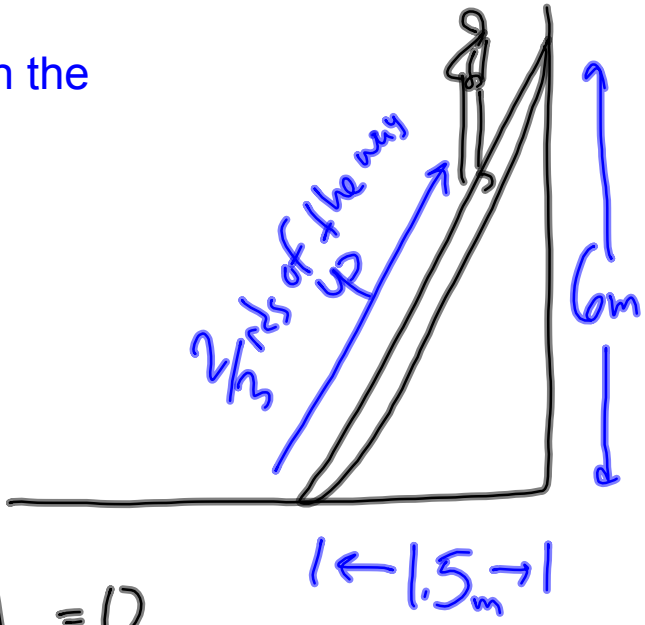

y
X
N_w
$m_p g$
N_f
m_L
F_f

Assume there's no friction between the ladder and wall.

mass of person: 75 kg

mass of ladder: 10 kg





$$f_f - N_w = 0$$

$$N_f - 100 - 750 = 0$$

$$-(0.75)(100) - (1)(750) + (6)N_w = 0$$