HW 8

4) $\tau_1 = (10\,kg)\cdot(9.8\,m/s^2)\cdot(.4\,m)\cdot(\sin 0^\circ) = 0$

$\tau_2 = (10\,kg)\cdot(9.8\,m/s^2)\cdot(.4\,m)\cdot(\sin 30^\circ) = 196\ N\cdot m$

$\tau_3 = (10\,kg)\cdot(9.8\,m/s^2)\cdot(.4\,m)\cdot(\sin 60^\circ) = 339\ N\cdot m$

$\tau_4 = (10\,kg)\cdot(9.8\,m/s^2)\cdot(.4\,m)\cdot(\sin 90^\circ) = 392\ N\cdot m$

9) $\sum \tau = (2.0\,kg)\cdot(9.8\,m/s^2)\cdot(.33\,m) - F_B\cdot(.08\,m)\cdot(\sin 15^\circ) = 0$

$\Longrightarrow F_B = 311\ N$

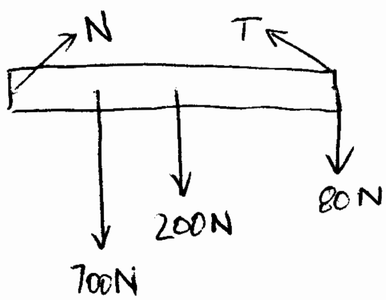
11) $\sum \tau = (260\,N)\cdot(\sin 20^\circ)(\cos 10^\circ)\cdot(.4\,m) - T(\sin 10^\circ)(\cos 10^\circ)(.4\,m) = 0$

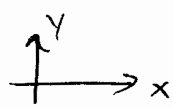
$\Longrightarrow T = 492\ N$ (in position a))

$\sum \tau = (250\,N)(\sin 60^\circ)(\cos 10^\circ)(.4\,m) - T(\sin 10^\circ)(\cos 10^\circ)(.4\,m) = 0$

$\Longrightarrow T = 1250\ N$ (in position b))

20) a)





b) $\sum F_x = N_x - T(\cos 60^\circ) = 0$

$\sum F_y = N_y + T(\sin 60^\circ) - 980\,N = 0$

$\sum \tau_{hinge} = \cancel{N_y \cdot 0}^{\,0} + T(\sin 60^\circ)(6\,m) - (80\,N)(6\,m) - (200\,N)(3\,m) - 700\,N\cdot m = 0$

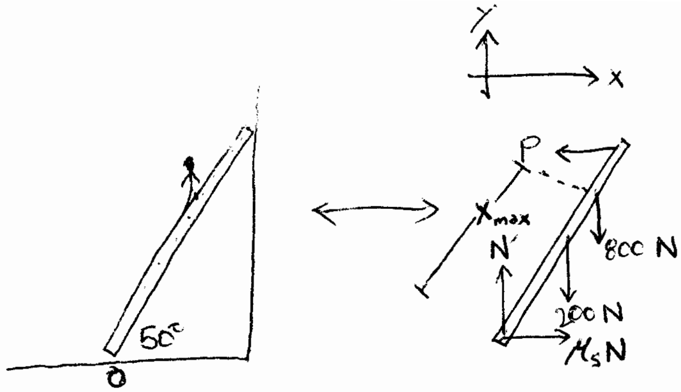
(for equilibrium)

$\Longrightarrow T = 342\ N \Longrightarrow N_x = 171\ N\ ;\ N_y = 683\ N$

c) $\sum \tau_{hinge} = (900\,N)(\sin 60^\circ)(6\,m) - (80\,N)(6\,m) - (200\,N)(3\,m) - (700\,N)x_{max} = 0$

$\Longrightarrow x_{max} = 5.15\ m$

25)



The net force and torque on the ladder should equal zero for equilibrium:

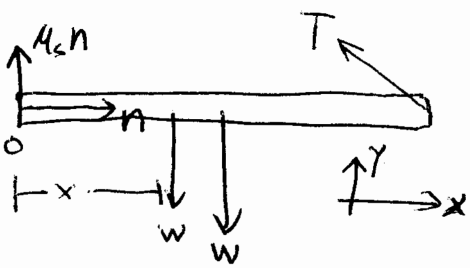
$$\sum F_x = (.6)N' - P = 0 \quad ; \quad \sum F_y = N' - 1000\text{ N} = 0 \; ;$$

$$\sum \tau_o = (200\text{ N})(\sin 40°)(4\text{ m}) + (800\text{ N})(\sin 40°)(x_{max}) - P(8\text{ m})(\sin 50°) = 0$$

$\Longrightarrow N' = 1000$ N ; $P = 600$ N ; By substitution,

$x_{max} = 6.15$ m

28)



As in 25), we have 3 conditions for equilibrium:

$$\sum F_x = n - T(\cos 37°) = 0 \; ; \; \sum F_y = \mu_s n + T(\sin 37°) - 2w = 0$$

$$\sum \tau_o = T(\sin 37°)(4\text{ m}) - w(x_{max} + 2.0\text{ m}) = 0$$

$$\Longrightarrow n = T(\cos 37°) \Longrightarrow T = \frac{2w}{(.5)(\cos 37°) + \sin 37°} \quad \text{(by substitution)}$$

$$\Longrightarrow x_{max} = 2.82\text{ m}$$