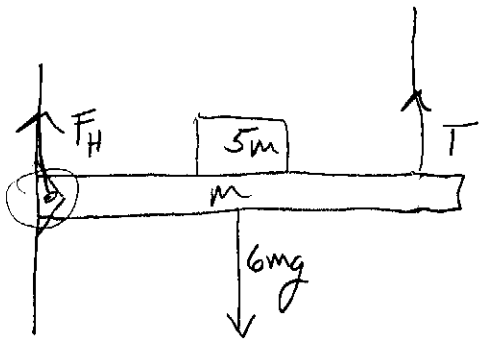
1>



1> $\Sigma F = 0$

$F_H + T = 6mg$

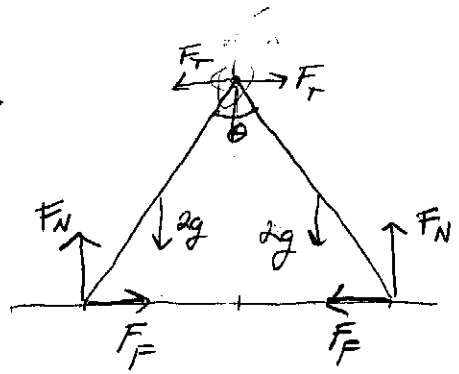
$\Sigma \tau = 0$

$(T)(9\ell) = 6mg(5\ell)$

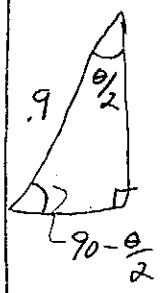
$9T = 30\,mg$

$\boxed{T = 3.33mg}$

2>



2> $\mu = .67$ $\Sigma F_y = 0$



$\Sigma \tau = 0$ $2F_N = 4g$

$F_N = 2g$

$F_F(.9)\cos\left(\frac{\theta}{2}\right) + 2g(.45)\cos\left(\frac{\theta}{2}\right)$

$= F_N(.9)\sin\left(\frac{\theta}{2}\right)$

$F_F\cos\left(\frac{\theta}{2}\right) + g\cos\left(\frac{\theta}{2}\right) = F_N\sin\left(\frac{\theta}{2}\right)$

$\mu F_N\cos\left(\frac{\theta}{2}\right) + g\cos\left(\frac{\theta}{2}\right) = F_N\sin\left(\frac{\theta}{2}\right)$

$(.67)(2g)\cos\left(\frac{\theta}{2}\right) + g\cos\left(\frac{\theta}{2}\right) = 2g\sin\left(\frac{\theta}{2}\right)$

$1.33\cos\left(\frac{\theta}{2}\right) + \cos\left(\frac{\theta}{2}\right) = 2\sin\left(\frac{\theta}{2}\right)$

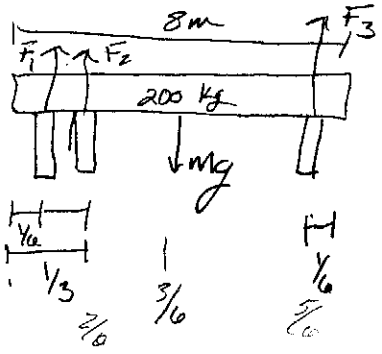
$2.33\cos\left(\frac{\theta}{2}\right) = 2\sin\left(\frac{\theta}{2}\right)$

$\frac{2.33}{2} = \tan\left(\frac{\theta}{2}\right)$

$\frac{\theta}{2} = 49.358°$

$\boxed{\theta = 98.7°}$

2)



3) $\Sigma F = 0$

$* F_1 + F_2 + F_3 = mg = 200g$

$\Sigma \tau_1 = 0$

$F_2\left(\frac{1}{6}\right)(8) + F_3\left(\frac{4}{6}\right)(8) = 200g\left(\frac{3}{6}\right)(8)$

$\frac{1}{6} F_2 + \frac{4}{6} F_3 = \frac{2}{6}(200g)$

$F_2 + 4F_3 = 400g$

$* F_2 = 400g - 4F_3$

$\Sigma \tau_{mg} = 0$

$F_1\left(\frac{2}{6}\right)(8) + F_2\left(\frac{1}{6}\right)(8) = F_3\left(\frac{2}{6}\right)(8)$

$* 2F_1 + F_2 = 2F_3$

$\Sigma \tau_2 = 0$

$F_1\left(\frac{1}{6}\right)(8) + 200g\left(\frac{1}{6}\right)(8) = F_3\left(\frac{3}{6}\right)(8)$

$F_1 + 200g = 3F_3$

$* F_1 = 3F_3 - 200g$

$\Sigma \tau_3 = 0$

$200g\left(\frac{2}{6}\right)(8) = F_2\left(\frac{3}{6}\right)(8) + F_1\left(\frac{4}{6}\right)(8)$

$* 400g = 3F_2 + 4F_1$

$F_1 = 528\ N$

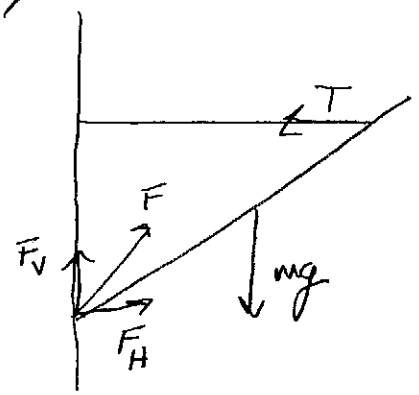
$F_2 = 603\ N$

$F_3 = 829\ N$

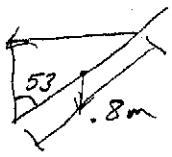
1	1	1	200g
0	1	4	400g
2	1	-2	0
1	0	-3	-200g
4	3	0	400g

53.8461
61.538
84.615

4)



$m = .75\ kg$



$\Sigma F_y = 0$ $\quad$ $\Sigma F_x = 0$

$T = F_H$ $\quad$ $mg = F_V$

$F_V = .75(9.8)$

$F_V = 7.35N$

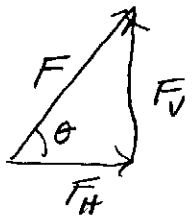
$\Sigma \mathcal{L} = 0$

$mg(.5)\sin 53 = T(.8)\cos 53$

$(.75)(9.8)(.5)\sin 53 = T(.8)\cos 53$

$$T = \frac{(.75)(9.8)(.5)\sin 53}{.8\cos 53}$$

$T = 6.096$



$F = F_V^2 + F_H^2$

$F = (7.35)^2 + (6.096)^2$ $\quad$ $\tan\theta = \frac{F_V}{F_H}$

$\theta = \tan^{-1}\frac{7.35}{6.096}$

$F = 9.55N$ @ $50.3°$ up

5) The cable needs a large enough cross-section to have a maximum strength higher than the load.

$T = 6.096\,N$

steel Tensile $= 500\times10^{6}\ N/m^2$

$= F/A$

$500\times10^{6} = \frac{6.096\,N}{A}$

$\boxed{A = 1.22\times10^{-8}\ m^2}$

6) The cord will stretch based on its physical properties.

6) $\Delta L = \left(\frac{1}{E}\right)\left(F/A\right)L_0$

$\Delta L = \left(\frac{1}{5\times10^{9}}\right)\left(\frac{325}{\pi\left(\frac{.001}{2}\right)^2}\right)(.45)$

$\Delta L = 3.72422\times10^{-2}$

$L + \Delta L = .487242$

$cir = 2\pi r$

$cir = 2\pi(.05)$

$cir = .31415$

$\text{Turns} = \frac{L+\Delta L}{cir} = \frac{.487242}{.31415}$

$\boxed{\text{Turns} = 1.55}$

7) The column will need to support its maximum strength in compression

7) $35\times10^{6} = \frac{F}{A} = \frac{mg}{A} = \frac{\rho\,Vol\,g}{A}$

$35\times10^{6} = \frac{\rho h \cdot Ag}{A} = \rho h g$

$h = \frac{35\times10^{6}}{\rho(9.8)}$

$\boxed{h = 3.57\times10^{6}\rho}$