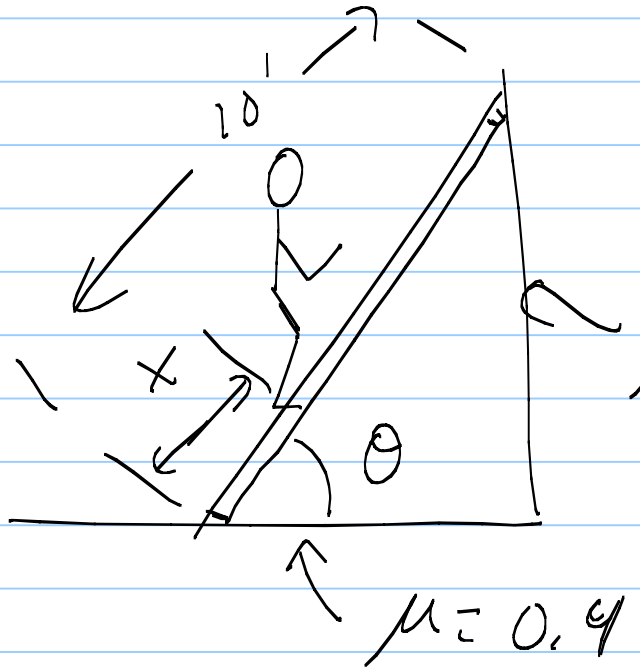
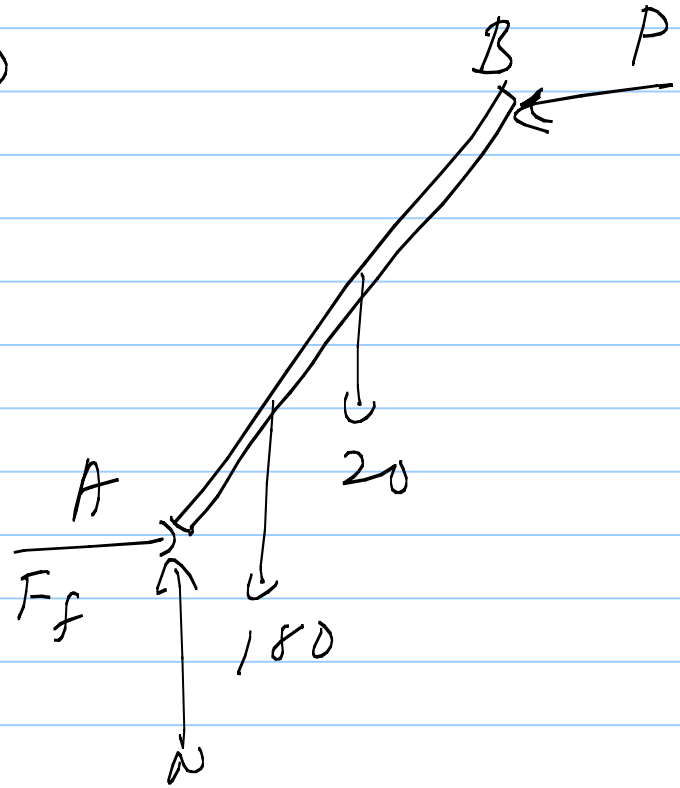
EGR 180 7/20/10

Note Title 7/20/2010



$w_p = 180$ lbs

$w_L = 20$ lbs



$$\sum M_A = -(x\cos\theta)(180) - 5\cos\theta(20) + 10\sin\theta P = 0$$

$$P = [18x + 10]\cot\theta)$$

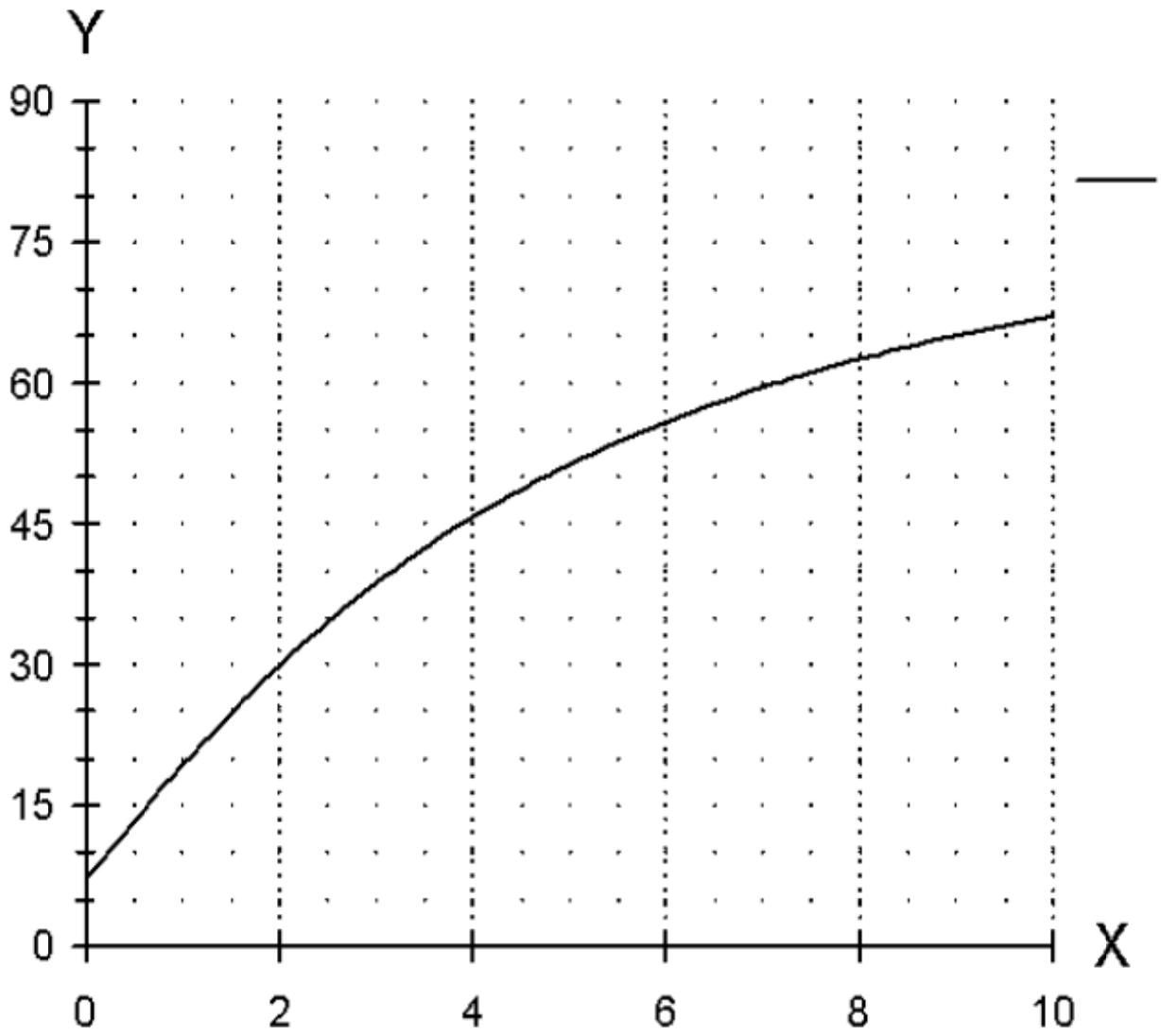
$$F_f = \mu N \quad , \quad \sum F_y = N - 180 - 20 = 0$$

$$= .4(200) \qquad \Rightarrow N = 200 \text{ lbs}$$

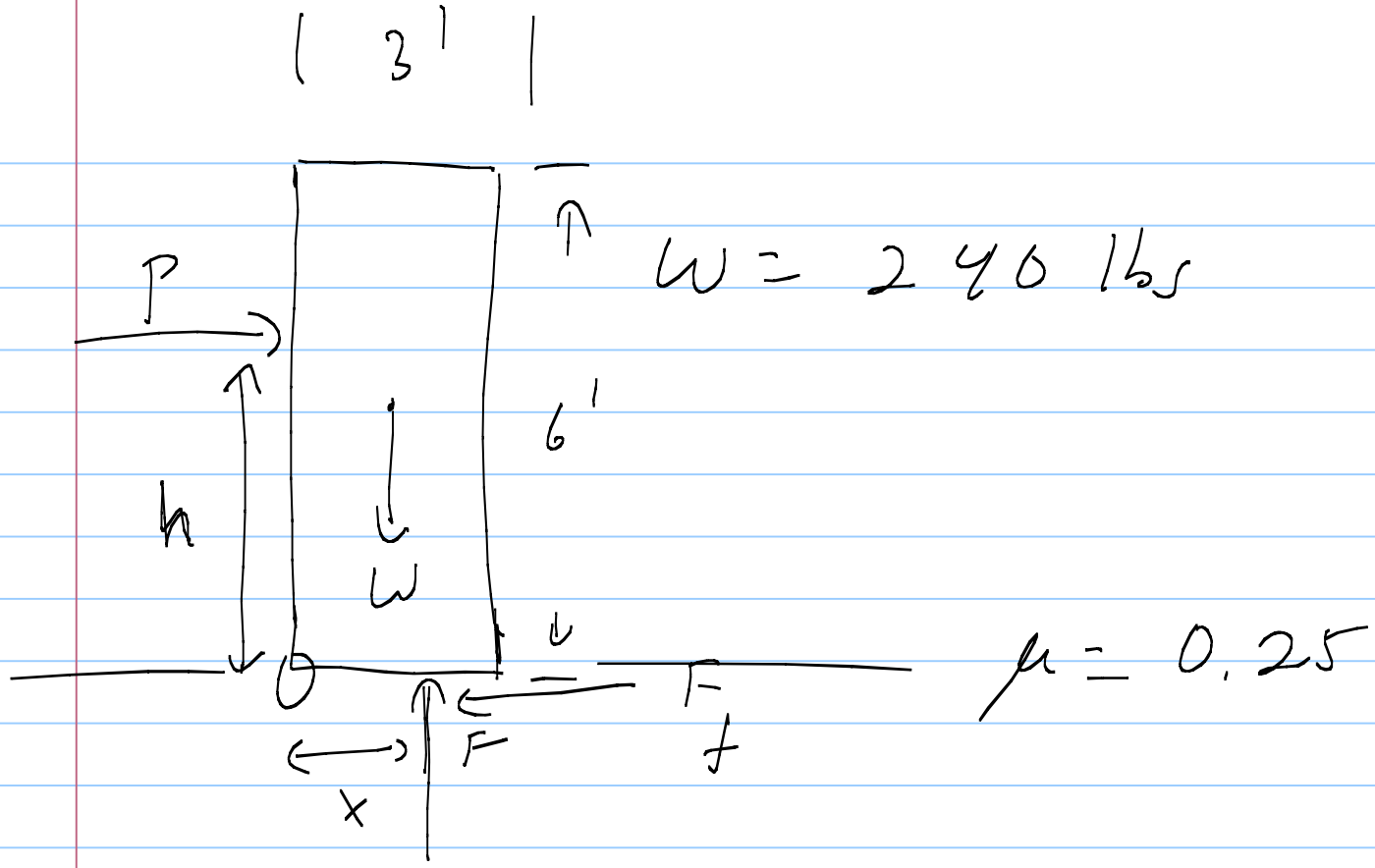
$$= 80 \text{ lbs}$$

$$\sum F_x = F_f - P = 0 \Rightarrow P = 80 \text{ lbs}$$

$$\tan(\theta) = \frac{18x + 10}{80} \Rightarrow \theta = \tan^{-1}\left(\frac{9x+5}{40}\right)$$



$$Y_0 = \frac{180 \mathrm{TAN}^{-1}\left(\frac{1}{40}(9X+5)\right)}{\pi}$$



$\sum F_y \Rightarrow F = W \qquad \sum F_x \Rightarrow P = F_f = \mu W$

$$\sum M_0 = -P \cdot h + Wx - 1.5W = 0$$

$$Ph = W(x - 1.5)$$

$$(.25)(240)h = 240(x - 1.5)$$

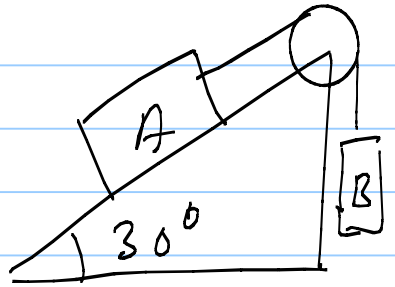
$$h = 4x - 6 \qquad x < 3$$

$$h_{max} = 4(3) - 6 = 12 - 6 = 6'$$

$$\mu = 0.4$$

$$h = 2.5x - 3.75$$

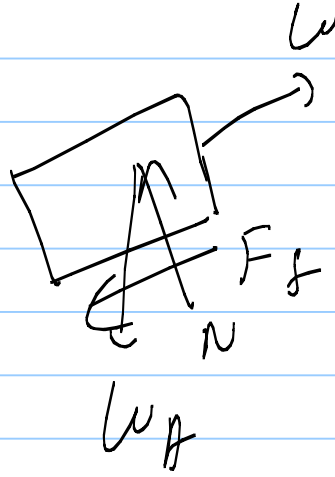
$$h_{max} = 7.5 - 3.75 = 3.75'$$



$W_A = 1000\ N$

$\mu = 0.4$

Min & max W_B that A will remain stationary



$\sum F_N = -W_A \cos(30) + N = 0$

$N = 500\sqrt{3}\ N$

$F_f = \mu N = 200\sqrt{3}\ N$

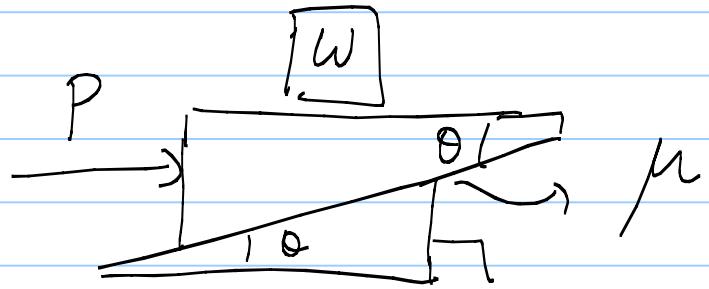
$$\oplus$$

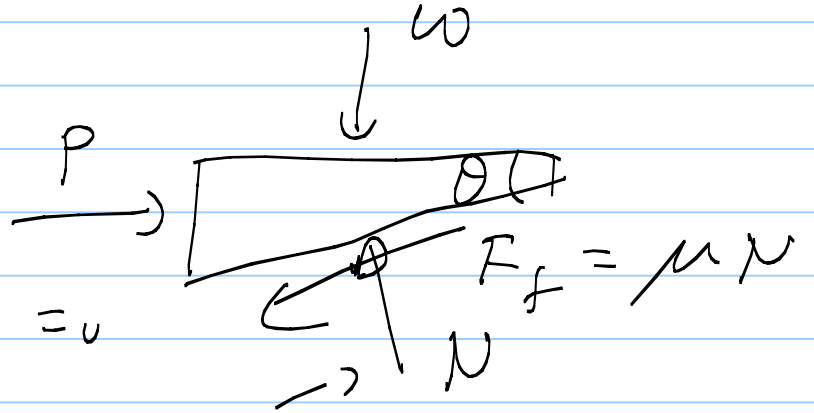
$$\sum F_T = -W_A \sin(30) - F_f + W_B$$

$$\ominus$$

$$W_{B_{max}} = (500 + 200\sqrt{3})\ N = 846\ N$$

$$W_{B_{min}} = (500 - 200\sqrt{3})\ N = 154\ N$$





$$\sum F_y = -W + N\cos\theta - F_f \sin\theta = 0$$

$$N[\cos\theta - \mu\sin\theta] = W$$

$$N = \frac{W}{\cos\theta - \mu\sin\theta}$$

$$\sum F_x = P - F_f\cos\theta - N\sin\theta = 0$$

$$P = N[\sin\theta + \mu\cos\theta]$$

$$\Rightarrow \quad P = \frac{W[\sin\theta + \mu\cos\theta]}{\cos\theta - \mu\sin\theta}$$

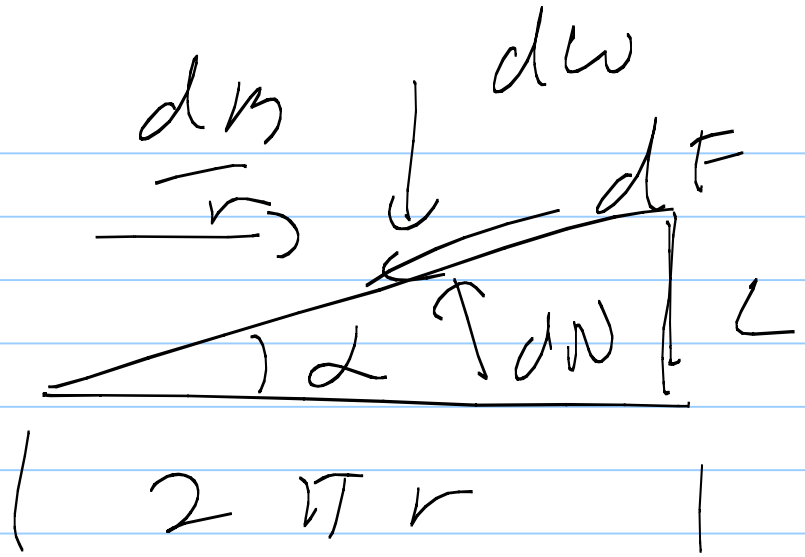
$W = 2000$ lbs, $\mu = 0.2$, $\theta = 5^\circ$

$$P = \frac{2000\left[\sin(5) + .2\cos(5)\right]}{\cos(5) - .2\sin(5)}$$

$$= 585 \text{ lbs}$$

$$\theta = \frac{W(\sin(\theta) - \mu\cos\theta)}{\cos(\theta) + \mu\sin\theta}$$

$$\mu > \tan\theta = \tan(5) = 0.09$$



$$\sum F_y = -dw + dN\cos\alpha - dF\sin\alpha = 0$$

$$dN = dw/[\cos\alpha - \mu\sin\alpha]$$

$$\frac{dM}{r} = \frac{dw[\sin\alpha + \mu\cos\alpha]}{\cos\alpha - \mu\sin\alpha}$$

$$\tan(\alpha) = \frac{L}{2\pi r}$$

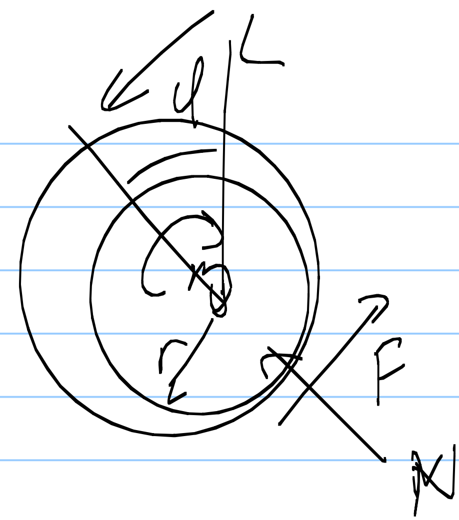
$$\frac{M}{r} = \frac{w[\sin(\alpha) + \mu\cos(\alpha)]}{\cos(\alpha) - \mu\sin\alpha}$$

$$\frac{M}{r} = \frac{W[L + 2\pi r\mu]}{2\pi r - \mu L}$$

Tighten

$$\frac{M}{r} = -\frac{W[L - 2\pi\mu r]}{2\pi r + \mu L}$$

Loosen



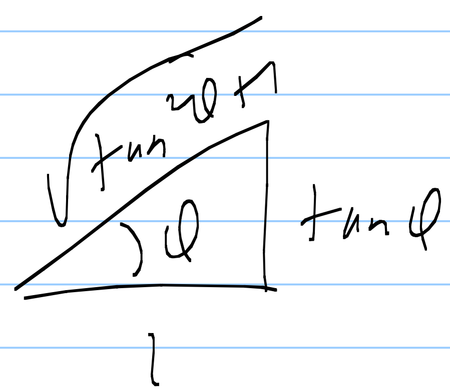
$$\sum M_c = -M + rF = 0$$

$$F = \frac{M}{r} \leftarrow$$

$$N = L\cos\varphi \qquad F = \mu N$$

$$F = L\sin\varphi = \mu L\cos\varphi$$

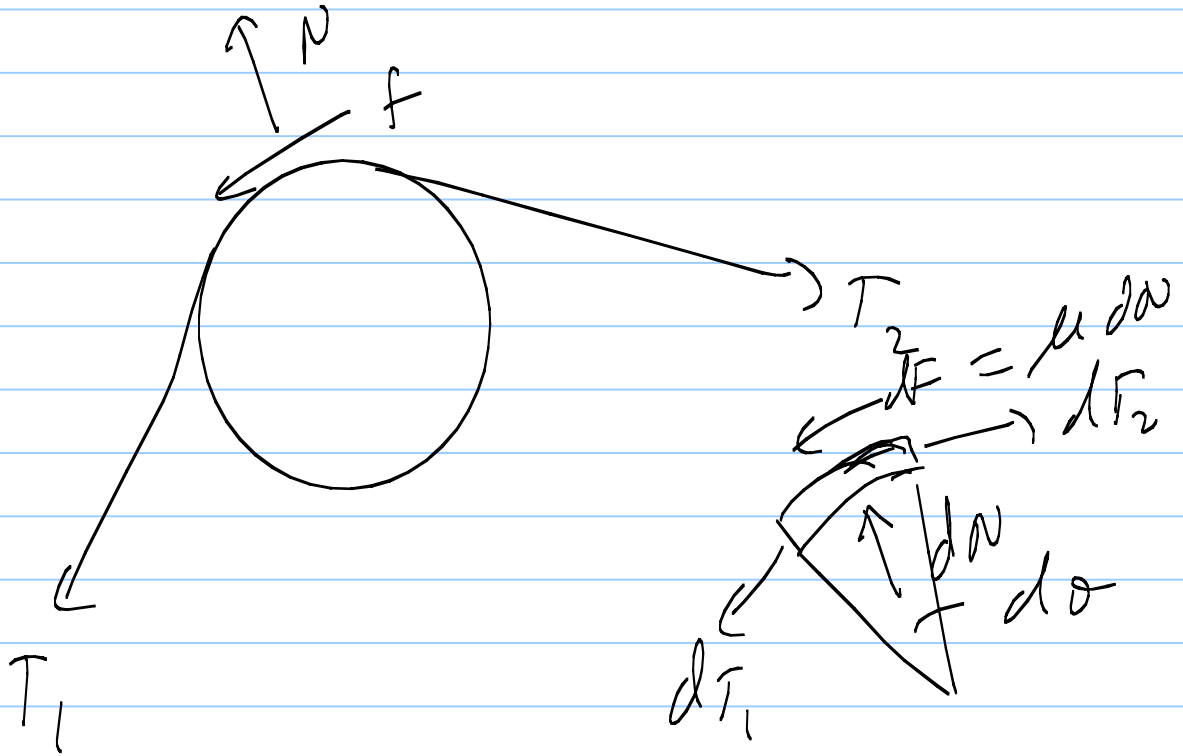
$$\tan\varphi = \mu$$



$$M = rF = rL\sin\varphi$$

$$= \underline{rL\tan\varphi}$$

$$n = \frac{rL\tan\varphi}{\sqrt{\tan^2\varphi+1}} = \frac{rL\mu}{\sqrt{1+\mu^2}} \sim rL\mu$$



$$\sum F_T = -dF - dT_1 \cos\frac{d\theta}{2} + dT_2 \cos\frac{d\theta}{2} = 0$$

$$\Delta T = \Delta F = \mu\, dN$$

$$\sum F_N = dN - dT_1 \sin\frac{d\theta}{2} - dT_2 \sin\frac{d\theta}{2} = 0$$

$$dN = T\, d\theta = \frac{dN}{d\theta} = T$$

$$\frac{dT}{d\theta} = \mu \frac{dN}{d\theta} = \mu T$$

$$\boxed{T(\theta) = T_1 e^{\mu\theta}}$$