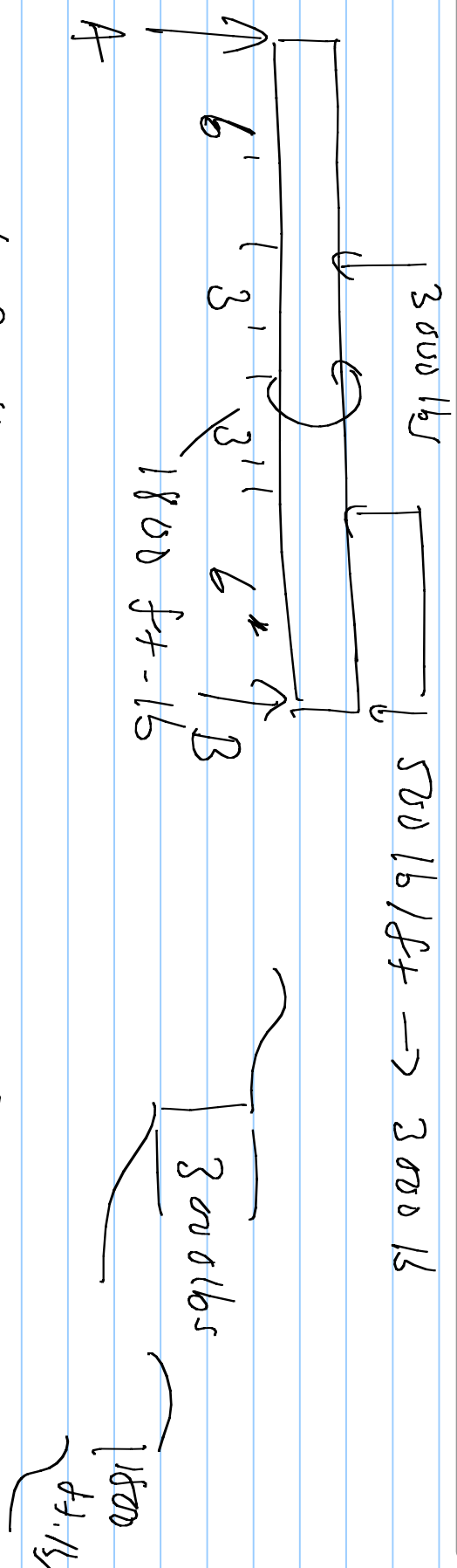


# EGR180 7/15

8-59)



$$\sum M_A = -6 \cdot 3000 + 1800 + 1800 + 1800 - 15 \cdot 3000 = 0$$

$$B = 3400 \text{ lbs}$$

$$\sum F_y = A - 3000 - 3000 + 3400 = 0 \Rightarrow A = 2600 \text{ lbs}$$

$$0 < x < 6, \quad 6 < x < 9, \quad 9 < x < 12, \quad 12 < x < 18$$

$$V(x) = \begin{cases} 2600 & 0 < x < 6 \\ -400 & 6 < x < 9 \\ -400 & 9 < x < 12 \\ 5600 - 500x & 12 < x < 18 \end{cases}$$

$$V' = -500$$

$$V(x) = -500x + C$$

$$V(12) = C - 6000 = -400$$

$$C = 5600$$

$$M(x) = \int V(x) dx = \begin{cases} 2600x & 0 < x < 6 \\ -400x + 1800 & 6 < x < 9 \\ -400x + 16200 & 9 < x < 12 \\ 5600x - 250x^2 - 19800 & 12 < x < 18 \end{cases}$$

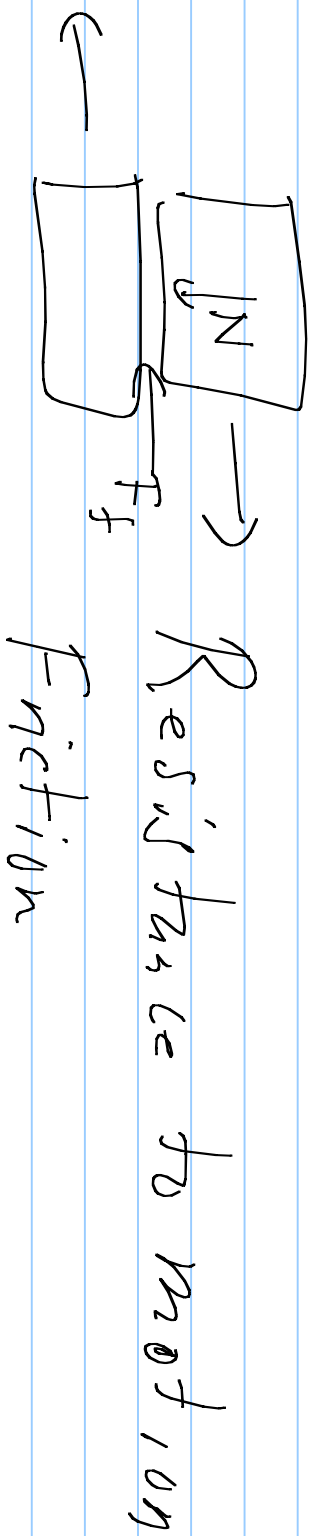
Axial force & Torsion

Frame, location Internal Axial, Shear  
& Bending Moment.

Shear force / Bending Moment Diagram

Cable

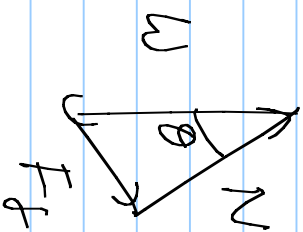
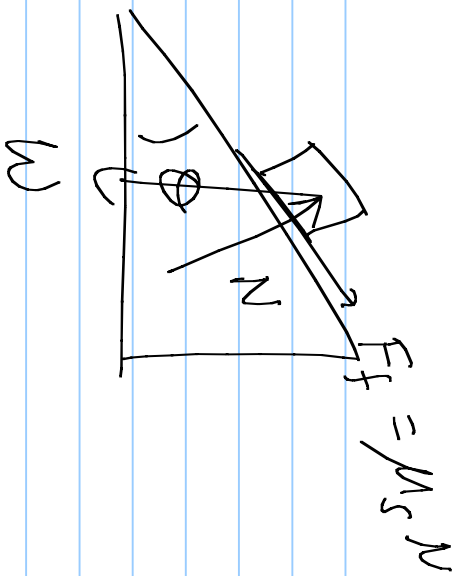
# Friction



Static  $\rightarrow$  Dynamic

$$\mu_s F_f = \mu_s N$$

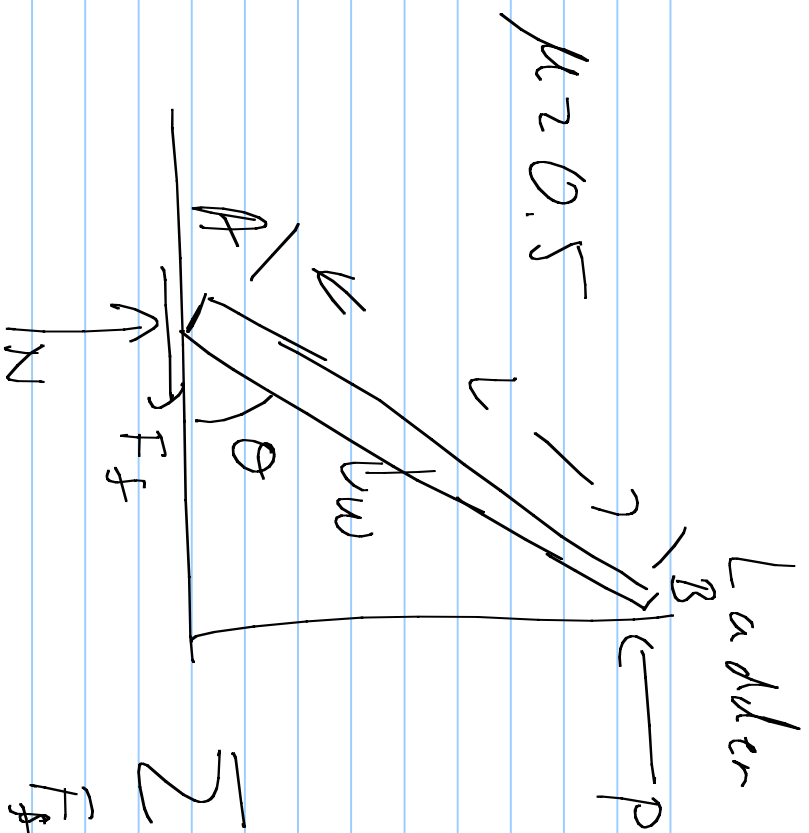
$$F < \mu_s N \text{ No motion}$$



$$\frac{F_f}{N} = \tan(\theta) = \mu_s$$

$$\theta = \tan^{-1}(\mu_s)$$

$$\mu_s = 0.4 \Rightarrow \theta = 21.8^\circ$$



$$\sum M_A = -\left(\frac{L \cos \theta}{2}\right) W + L \sin \theta \cdot P = 0$$

$$P = \frac{W \cos \theta}{2}$$

$$\sum F_y = N - W = 0 \Rightarrow N = W$$

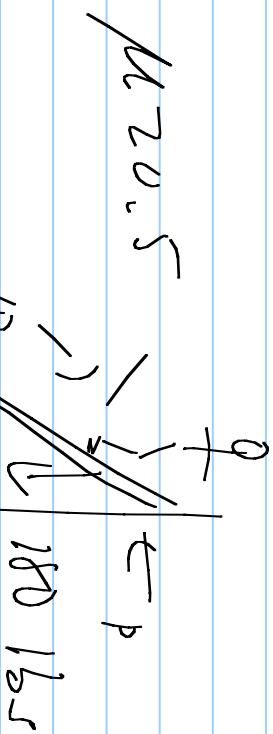
$$F_f = \mu N = \mu W$$

$$\sum F_x \Rightarrow F_f = P = \frac{W}{2} \cos \theta$$

$$\cot \theta = 2 \mu$$

$$\theta = \cot^{-1}(2\mu) \Rightarrow \theta = 45^\circ$$

$$W = 20 \text{ lbs}, \quad L = 12' \quad \sum M_A = -6 \cos \theta (20) - 10 \cos \theta \cdot 180$$



$$12 \sin \theta \cdot P = 0$$

$$P = 160 \cot \theta$$

$$\sum F_y = N - 20 - 180 = 0$$

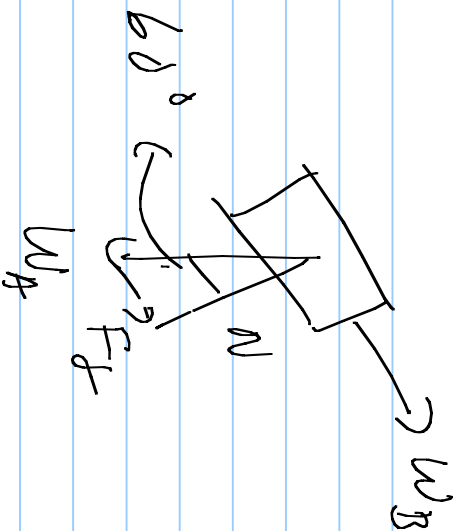
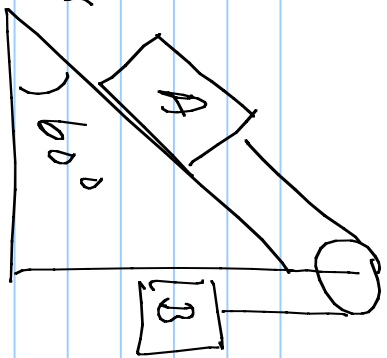
$$N = 200 \text{ lbs}$$

$$F_t = (200)(200) = 400 = 160 \cot \theta$$

$$\theta = \cot^{-1} \left( \frac{400}{160} \right) \Rightarrow \theta = 58.8^\circ$$

$$\mu = 0,3$$

$$F = 100 \text{ lbs}$$



$$N = W_A \cos(60)$$

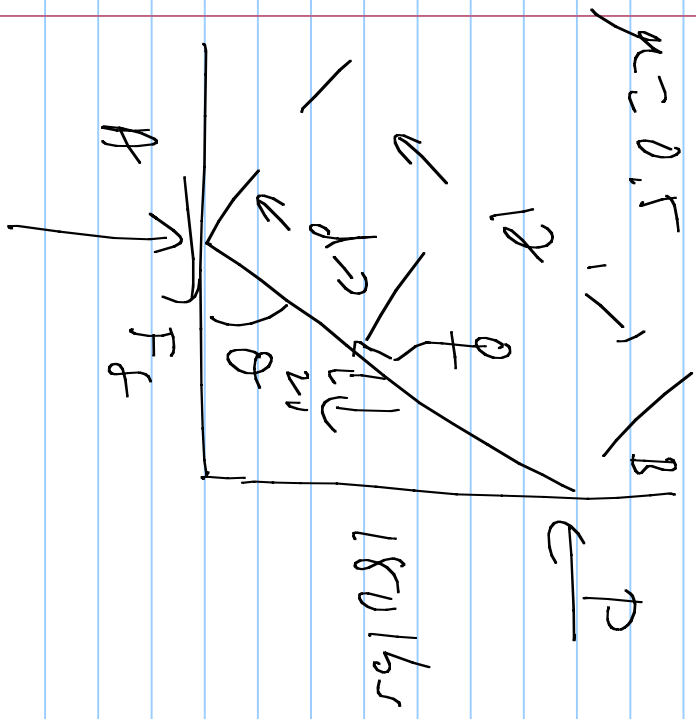
$$= 100/2 = 50 \text{ lbs}$$

$$F_f = \mu N = 15 \text{ lbs}$$

$$W_A \sin(60) = 50\sqrt{3} \text{ lbs}$$

$$\sum F_T = -50\sqrt{3} + 15 + W_B = 0 \Rightarrow W_B = 21.6 \text{ lbs}$$

$$W_B = 101.6 \text{ lbs}$$



$$\mu = 0.15$$

$$\sum M_A = -d \cos \theta \cdot 180 - 6 \cos \theta \cdot 20 + 12.5 \sin \theta \cdot P = 0$$

$$P = (10 + 15d) \cot(\theta)$$

$$= \mu (200) = 180$$

$$\cot(\theta) = \frac{180}{10 + 15d}$$

$$\tan \theta = \frac{10 + 15d}{180} = 1 + 15d$$

$$\theta = \tan^{-1}(1 + 15d)$$

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$$\theta = 5.7^\circ$$

$$d = 0$$

$$\theta = 62.2^\circ$$

$$d = 12'$$