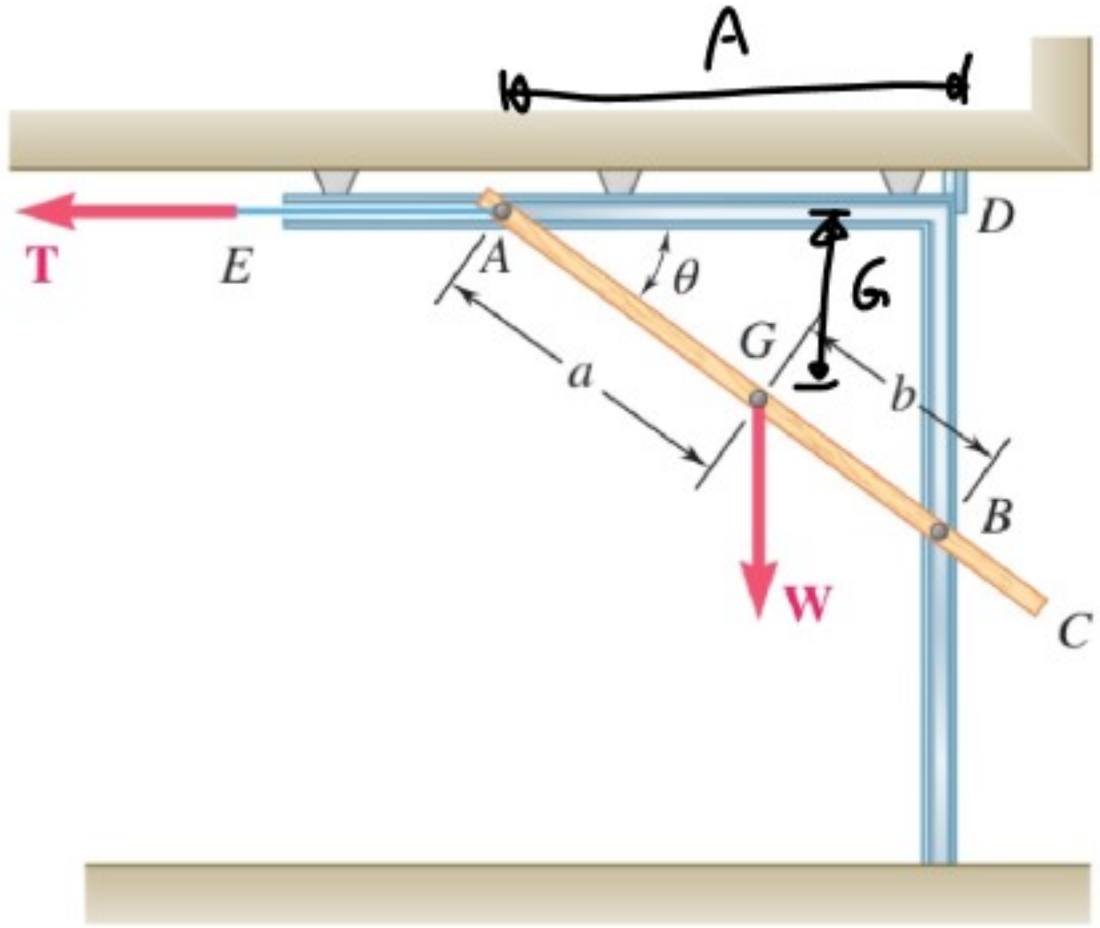
10.9 An overhead garage door of weight W consists of a uniform rectangular panel AC supported by a cable AE attached at the middle of the upper edge of the door and by two sets of frictionless rollers A and B that can slide in horizontal and vertical channels. Express the tension T in cable AE in terms of W, a, b, and θ.



$$A = (a+b)\cos\theta$$

$$\frac{dA}{d\theta} = -(a+b)\sin\theta$$

$$dA = -(a+b)\sin\theta\, d\theta$$

$$G = a\sin\theta$$

$$\frac{dG}{d\theta} = a\cos\theta$$

$$dG = a\cos\theta\, d\theta$$

$$\frac{-dA}{(a+b)\sin\theta} = d\theta$$

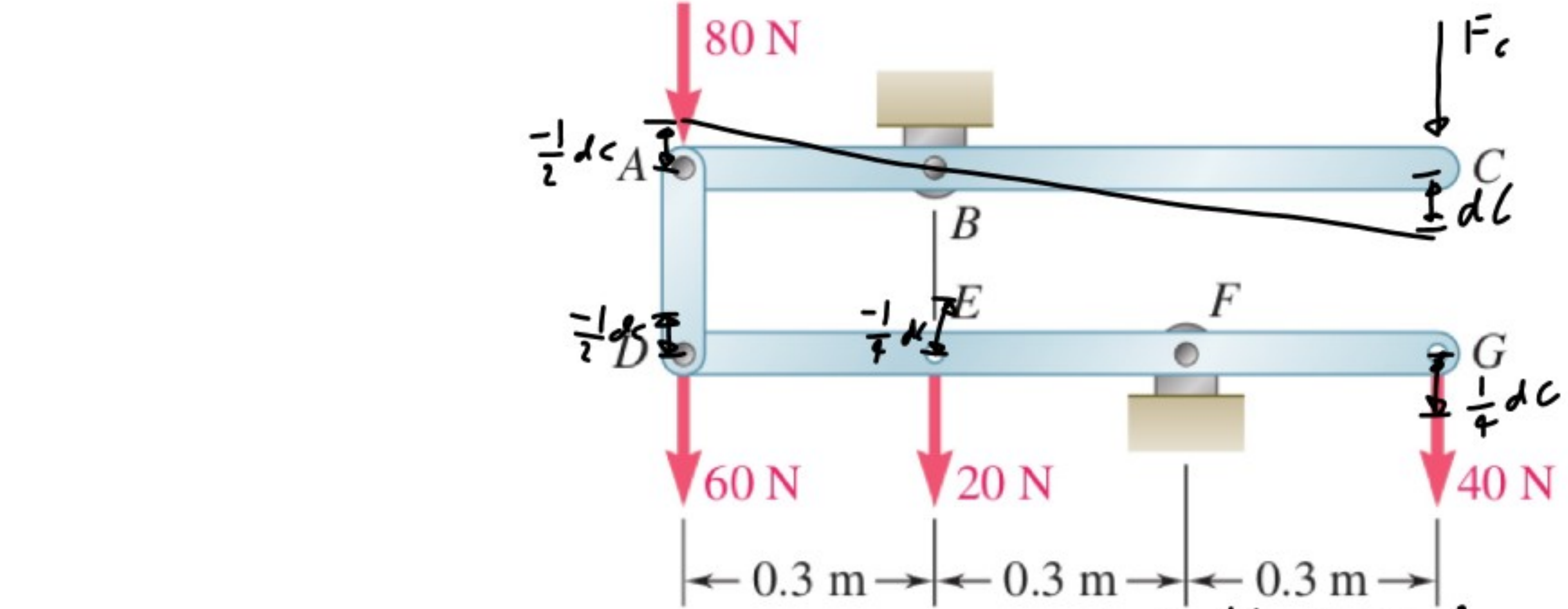
$$dG = a\cos\theta\, d\theta = \frac{-a}{a+b}\frac{\cos\theta}{\sin\theta}\, dA = \frac{-a}{a+b}\cot\theta\, dA$$

$$T\,dA = W\,dG$$

$$T\,dA = \frac{-Wa}{a+b}\cot\theta\, dA$$

$$T = \frac{-Wa}{a+b}\cot\theta$$

10.1 Determine the vertical force **P** that must be applied at *C* to maintain the equilibrium of the linkage.



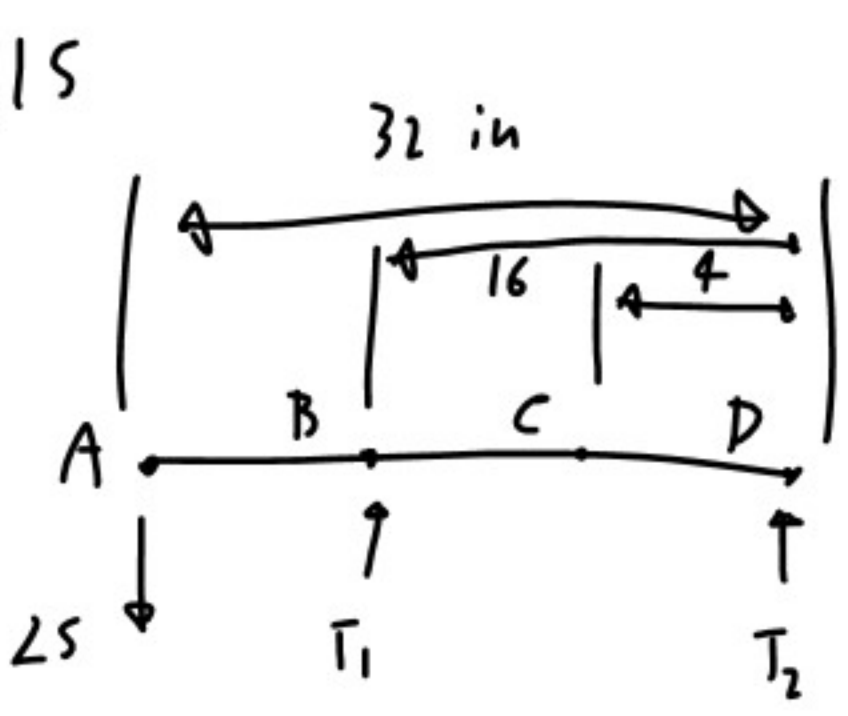
$$F_c d_C + F_A d_A + F_D d_D + F_E d_E + F_G d_G = 0$$

$$F_c d_c + 80\left(\frac{-1}{2} d_c\right) + 60\left(\frac{-1}{2} d_c\right) + 20\left(\frac{-1}{4} d_c\right) + 40\left(\frac{1}{4} d_c\right) = 0$$

$$F_c - 40 - 30 - 5 + 10 = 0$$

$$F_c = 40 + 30 + 5 - 10 = \boxed{65\ N}$$

8.115



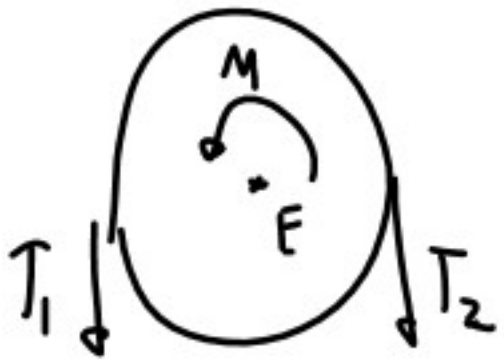
$$\Sigma M_C = +4T_2 - 12T_1 + 28 \cdot 25 = 0$$

$$\frac{T_1}{T_2} = e^{\mu_K \beta} = e^{0.25\pi} = 2.19 \quad \Rightarrow \quad T_1 = 2.19\,T_2$$

$$4T_2 - 12 \cdot 2.19\,T_2 + 700 = 0$$

$$(26.28 - 4)\,T_2 = 700$$

$$T_2 = 31.4 \text{ lb} \qquad T_1 = 2.19\,T_2 = 2.19 \cdot 31.4 = 68.8$$



$$\Sigma M_E = 0$$

$$M + 8T_1 - 8T_2 = 0$$

$$M = 8(T_2 - T_1)$$

$$= 8(31.4 - 68.8) = \boxed{-300 \text{ in-lbs}}$$

part a

Group work in class

Homework due each class meeting

Go over homework in class