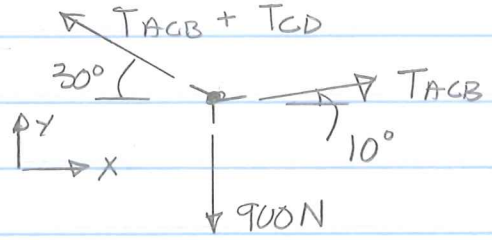
ME 35a HW#1 Solution

2.53 FBD of pulley



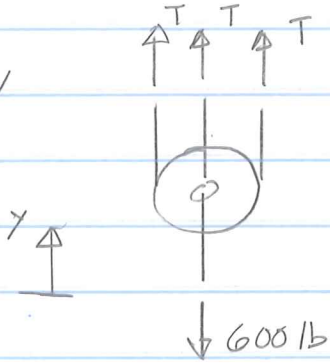
$\Sigma F_x = 0$: $-(T_{ACB} + T_{CD}) \cos 30^\circ + T_{ACB} \cos 10^\circ = 0$

$\Sigma F_y = 0$: $(T_{ACB} + T_{CD}) \sin 30^\circ + T_{ACB} \sin 10^\circ - 900\,N = 0$

Solve: $T_{ACB} = 900N \cdot \sqrt{3} / (\sqrt{3} \cdot \sin 10^\circ + \cos 10^\circ) = 1213\,N$

$T_{CD} = T_{ACB} (\cos 10^\circ - \cos 30^\circ) / \cos 30^\circ = 166.3N$

2.67 part d FBD of lower pulley

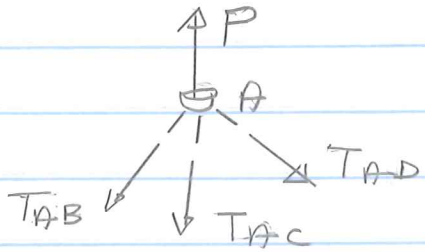


$\Sigma F_y = 0$:

$3T - 600\,lb = 0$

$\boxed{T = 200\,lb}$

2.136 FBL of balloon base



(1) $\Sigma F_x = 0$: $-T_{AB} \cdot \frac{4.20\,m}{L_{AB}} + T_{AC} \cdot \frac{2.40\,m}{L_{AC}} = 0$

(2) $\Sigma F_y = 0$: $-T_{AB} \cdot \frac{5.60\,m}{L_{AB}} - T_{AC} \frac{5.60\,m}{L_{AC}} - T_{AD} \cdot \frac{5.60\,m}{L_{AD}} + P = 0$

(3) $\Sigma F_z = 0$: $T_{AC} \cdot \frac{4.20\,m}{L_{AC}} - T_{AD} \frac{3.30\,m}{L_{AD}} = 0$

$L_{AB} = [(4.20\,m)^2 + (5.60\,m)^2]^{\frac{1}{2}} = 7\,m$

$L_{AC} = [(2.4\,m)^2 + (4.2\,m)^2 + (5.60\,m)^2]^{\frac{1}{2}} = 7.4\,m$

$L_{AD} = [(3.3\,m)^2 + (5.6\,m)^2]^{\frac{1}{2}} = 6.5\,m$

$T_{AC} = 444\,N$ (given)

From (1): $T_{AB} = T_{AC} \frac{2.4}{4.2} \cdot \frac{L_{AB}}{L_{AC}} = 240\,N$

From (3): $T_{AD} = T_{AC} \frac{4.2}{3.3} \frac{L_{AD}}{L_{AC}} = 496.4\,N$

From (4): $P = 5.60\,m \left(\frac{T_{AB}}{L_{AB}} + \frac{T_{AC}}{L_{AC}} + \frac{T_{AD}}{L_{AD}} \right) = 995.6\,N$