Solución: Primer Examen Final Colegiado 2014-2

Estática — Matutino

1.- $\vec{T}_{AD} = 288\left(\frac{1}{4}\hat{i}, \frac{\sqrt{3}}{4}\hat{j}, \frac{\sqrt{3}}{2}\hat{k}\right)[N]$

$\vec{T}_{BD} = T_{BD}\left(-\frac{1}{4}\hat{i} - \frac{\sqrt{3}}{4}\hat{j} + \frac{\sqrt{3}}{2}\hat{k}\right)[N]$

$\vec{T}_{CD} = T_{CD}\left(\frac{\sqrt{3}}{4}\hat{i} - \frac{1}{4}\hat{j} + \frac{\sqrt{3}}{2}\hat{k}\right)[N]$

$\vec{W} = W(\hat{i} + \hat{j} - \hat{k})\ N$

Equilibrio

$\Sigma F_x = 72 - \frac{1}{4}T_{BD} + \frac{\sqrt{3}}{4}T_{CD} = 0$

$\Sigma F_y = 72\sqrt{3} - \frac{\sqrt{3}}{4}T_{BD} - \frac{1}{4}T_{CD} = 0$

$\Sigma F_z = 144\sqrt{3} + \frac{\sqrt{3}}{2}T_{BD} + \frac{\sqrt{3}}{2}T_{CD} - W = 0$

Resolviendo el sistema

$\underline{T_{BD} = 144\,N}$; $\underline{T_{CD} = 249.41\,N}$; $\underline{W = 590.12\,N}$

2.- $\vec{r}_{C/B} = 6\hat{j} - \hat{k}\ [m]$

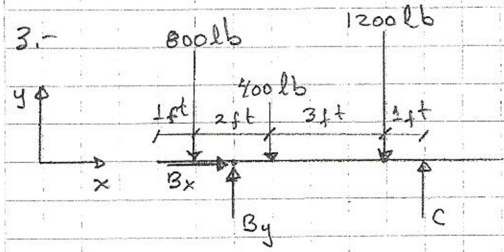
$\vec{F} = -30\hat{j} + 40\hat{k}\ [N]$

$\vec{M}_B = \vec{r}_{C/B} \times \vec{F} = 210\hat{i}\quad [N\cdot m]$

$\hat{u}_{AB} = \frac{1}{\sqrt{34}}(5, 0, -3)$

$\vec{M}_{AB} = 154.41\hat{i} - 92.65\hat{k}\ [N\cdot m]$

3.-



$B_x = 0$

$\Sigma F_y = B_y + C - 2400 = 0$

$\circlearrowleft\!+\ \Sigma M_B = (1)(800) - (1)(400) - 4(1200) + 5C = 0$

$\underline{C = 880\ lb}$; $\underline{B_y = 1520\ lb}$

4.- $\bar{x} = \dfrac{x_1 m_1 + x_2 m_2}{m_1 + m_2}$

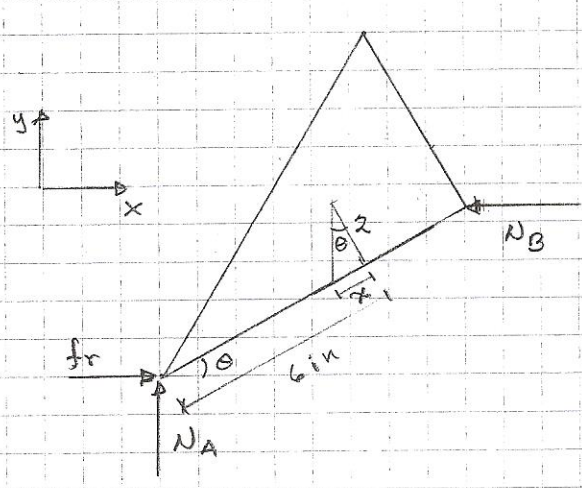
Como la densidad es constante

$\bar{x} = \dfrac{x_1 \rho_1 V_1 + x_2 \rho_2 V_2}{\rho_1 V_1 + \rho_2 V_2}$

$\rho_2 = \dfrac{(\bar{x} V_1 - x_1 V_1)\rho_1}{x_2 - \bar{x}\, V_2}$ y $V_1 = V_2$

$\rho_2 = \left(\dfrac{\bar{x} - x_1}{x_2 - \bar{x}}\right)\rho_1$; $\underline{\rho_2 = 8400\ kg/m^3}$

5.-



$\Sigma F_x = f_r - N_B = 0 \Rightarrow \mu N_A = N_B$

$\Sigma F_y = N_A - W = 0 \Rightarrow N_A = W$

$\Rightarrow N_B = \mu W$

$\circlearrowleft\!+\ \Sigma M_A = 9\,\text{sen}\,\theta\, N_B - (6 - x)\cos\theta\, W = 0$

$\Rightarrow 9\,\text{sen}\,\theta\,\mu W - (6 - 2\tan\theta)\cos\theta\, W = 0$

$9\mu\,\text{sen}\,\theta - 6\cos\theta + 2\,\text{sen}\,\theta = 0$

$6.5\,\text{sen}\,\theta = 6\cos\theta \Rightarrow \tan\theta = 0.923$

$\underline{\theta = 42.70^\circ}$