Solución: Primer Examen Final Colegiado 2013-2
Estática

Matutino

1) $\hat{e}_{AB} = \frac{(-0.8,\ 0.4,\ 0.8)}{1.2}$

Tensión en el cable

$\vec{T} = -80\hat{i} + 40\hat{j} + 80\hat{k}$

$\vec{r}_B = 0.4\hat{j} + 0.2\hat{k}$ m

Con respecto al origen

$\vec{M}_O = \vec{r}_B \times \vec{T} = 24\hat{i} - 16\hat{j} + 32\hat{k}$ N·m

$|M_{yy}| = 16$ N·m

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2) $\vec{F}_1 = 20\hat{i} + 95\hat{j} - 40\hat{k}$ lb

$\vec{F}_2 = 60\hat{i} - 40\hat{j} + 120\hat{k}$ lb

$\vec{F}_3 = 0\hat{i} - F_3\hat{j} + 0\hat{k}$ lb

$\vec{R} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3$

$\vec{R} = 80\hat{i} + (55 - F_3)\hat{j} + 80\hat{k}$ lb

Con respecto al origen

$\vec{r}_1 = 20\hat{i} + 24\hat{k}$ in

$\vec{r}_2 = 35\hat{j} + 24\hat{k}$ in

$\vec{r}_3 = 16\hat{i} + 24\hat{k}$ in

$\vec{M}_1 = \vec{r}_1 \times \vec{F}_1 = 5(-456\hat{i} + 256\hat{j} + 380\hat{k})$ lb·in

$\vec{M}_2 = \vec{r}_2 \times \vec{F}_2 = 5(1032\hat{i} + 288\hat{j} - 420\hat{k})$ lb·in

$\vec{M}_3 = \vec{r}_3 \times \vec{F}_3 = F_3(24\hat{i} - 16\hat{k})$ lb·in

$\vec{M}_O = \vec{M}_1 + \vec{M}_2 + \vec{M}_3$

① $\rightarrow \vec{M}_O = (2880 + 24F_3)\hat{i} + 2720\hat{j} - (200 + 16F_3)\hat{k}$

Ya que se reduce a una sola fuerza

$\vec{R} \cdot \vec{M}_O = 0$; $\vec{R} \cdot \vec{M}_O = 2080F_3 - 364000 = 0$

$F_3 = 175$ lb

$\vec{M}_O = 7080\hat{i} + 2720\hat{j} - 3000\hat{k}$ lb·in

$\vec{r}_Q = (x, y, 0)$; $\vec{R} = 80\hat{i} - 120\hat{j} + 80\hat{k}$ lb

② $\rightarrow \vec{M}_O = \vec{r}_Q \times \vec{R} = 80y\hat{i} - 80x\hat{j} - (120x - 80y)\hat{k}$

igualando ① y ②

$x = -34$ in ; $y = 88.5$ in

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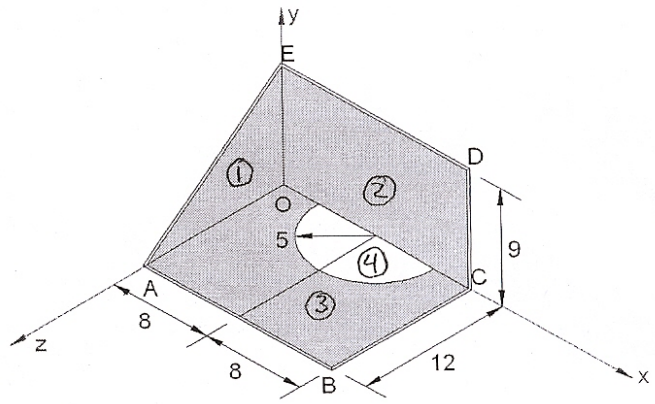
3)



	$\bar{x}_i$ [in]	$\bar{y}_i$ [in]	$\bar{z}_i$ [in]	W_i [lb]	x_iW_i [lb·in]	$\bar{y}W_i$ [lb·in]	zW_i [lb·in]
①	0	3	4	3.37	0	10.13	13.5
②	8	4.5	0	9.	72	40.5	0
③	8	0	6	12	96	0	72
④	8	0	2.12	2.45	19.63	0	5.21

$W_T = W_1 + W_2 + W_3 - W_4 = 21.92$ lb

$\Sigma \bar{x}_i W_i = x_1W_1 + x_2W_2 + x_3W_3 - x_4W_4 = 148.37$ lb

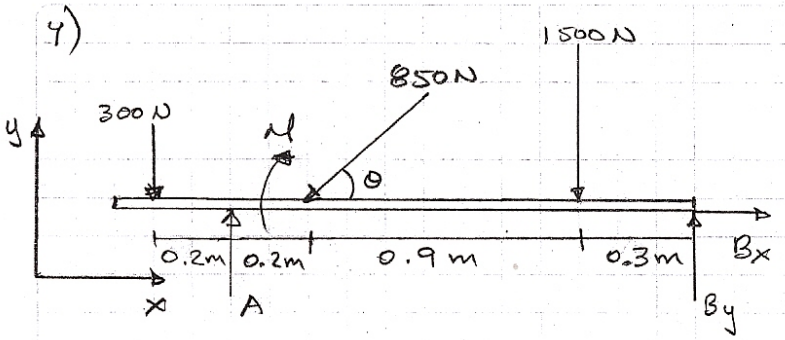
$\Sigma \bar{y}_i W_i = y_1W_1 + y_2W_2 + y_3W_3 - y_4W_4 = 2.31$ lb

$\Sigma \bar{z}_i W_i = z_1W_1 + z_2W_2 + z_3W_3 - z_4W_4 = 3.66$ lb·

$\bar{x} = 6.77$ in , $\bar{y} = 2.31$ in , $\bar{z} = 3.66$ in

Se puede resolver considerando únicamente el volumen.

4)



$M = 1200\ N\cdot m$

$\cos\theta = \frac{3}{5}$; $\operatorname{sen}\theta = \frac{4}{5}$

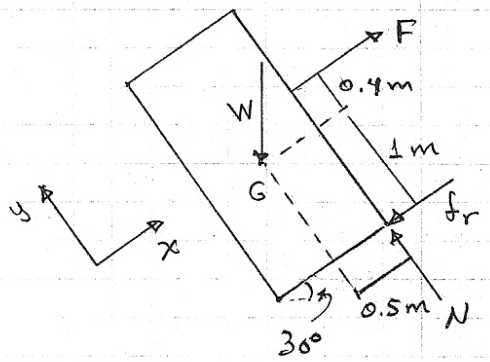
$\Sigma F_x = B_x - 850\left(\frac{3}{5}\right) = 0 \qquad \underline{B_x = 510\ N}$

$\Sigma F_y = A - 300 - 850\left(\frac{4}{5}\right) - 1500 + B_y = 0 \Rightarrow A + B_y = 2480$

$\Sigma M_A = 0.2(300) - 1200 - 0.2(850)\left(\frac{4}{5}\right) - 0.9(1500) + 1.2\,B_y = 0$

$\Rightarrow 1.2\,B_y = 2626 \rightarrow \underline{B_y = 2188.33\ N} \Rightarrow \begin{cases} \underline{A = 291.66\ N} \\ \underline{B = 2246.97\ N} \end{cases}$

5)



Deslizamiento

$\Sigma F_x = F - f_r - W\operatorname{sen}30° = 0$

$\Sigma F_y = N - W\cos 30° = 0 \qquad N = \frac{\sqrt{3}}{2}W$

de $f_r = \mu_s N = \frac{\sqrt{3}}{2}\mu_s W$

sust. en $\Sigma F_x \rightarrow F = \frac{1}{2}(\sqrt{3}\,\mu_s + 1)W$

$F = 732.23\ N$

Volcamiento

$\Sigma M_G = -(1)f_r + 0.5N - 0.4F = 0 \qquad$ de $\Sigma F_x \rightarrow f_r = F - \frac{1}{2}W$

$\Rightarrow -\left(F - \frac{1}{2}W\right) + 0.5\left(\frac{\sqrt{3}}{2}W\right) - 0.4F = 0$

$F = 523.02\ N$

$\underline{F = 523.02\ N}$ tiende a volcarse primero