Solución al Primer Final de Estática (Vespertino) Semestre: 2012-2

1)

-Al nivel del mar

a) $F = G\frac{M_T m}{R_T^2} = W$

$$GM_T = gR_T^2 \ldots (1)$$

-A la altura de h

$$W' = G\frac{M_T m}{(R_T + h)^2}$$

$$W' = \frac{R_T^2\, gm}{(R_T + h)^2}$$

$$W' = 0.999W$$

$$\Delta W = W' - W$$

$$\underline{\Delta W = 2.5x10^{-4}\ [N]}$$

b) $W' = 0.99\, mg$

$$G\frac{M_T m}{(R_T + H)^2} = 0.99\, mg$$

$$= 0.99G\frac{M_T m}{R_T^2}$$

$$\frac{1}{(R_T + H)^2} = \frac{0.99}{R_T^2}$$

$$R_T^2 = 0.99(R_T + H)^2$$

$$R_T = \sqrt{0.99}(R_T + H)$$

$$\underline{H = 31.93\ [km]}$$

2)

$$\vec{R} = \sum \vec{F}$$

$$\vec{R} = 4\hat{\imath} + (b-4)\hat{\jmath} + 5\hat{k}\ [N]$$

$$\overrightarrow{M_1} = \overrightarrow{r_A}\ x\ \overrightarrow{F_A} = 20\hat{\imath} + 10\hat{\jmath}\ [N \cdot m]$$

$$\overrightarrow{M_2} = \overrightarrow{r_B}\ x\ \overrightarrow{F_B} = -30\hat{\jmath} + 5b\hat{k}\ \ [N \cdot m]$$

$$\overrightarrow{M_3} = \overrightarrow{r_C}\ x\ \overrightarrow{F_C} = 12.5\ \hat{\jmath}\ \ [N \cdot m]$$

$$\overrightarrow{M_4} = \overrightarrow{r_D}\ x\ \overrightarrow{F_D} = -20\hat{\imath} + 10\hat{k}\ \ [N \cdot m]$$

$$\overrightarrow{M_5} = \overrightarrow{r_E}\ x\ \overrightarrow{F_E} = 20\hat{\jmath}\ \ [N \cdot m]$$

$$\overrightarrow{M_6} = \overrightarrow{r_G}\ x\ \overrightarrow{F_G} = 12.5\ \hat{\jmath}\ \ [N \cdot m]$$

$$\sum \overrightarrow{M_O} = \overrightarrow{M_O} = 25\hat{\jmath} + (5b+10)\hat{k}$$

Se debe de cumplir;

$$\vec{R} \cdot \overrightarrow{M_O} = 0\ \Rightarrow 25(b-4) + 5(5b+10) = 0$$

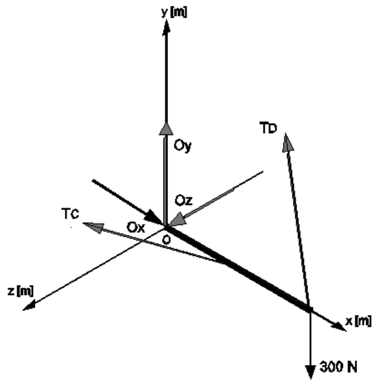
$$b = 1$$

de $\vec{r} x \vec{R} = \overrightarrow{M_O}$ con $\vec{r} = (x, y, z)$ ec. de la recta $\frac{5x+25}{4} = -\frac{5}{3}y = z$

3)

Superficie	x_i [cm]	y_i $[cm]$	A_i $[cm^2]$	$A_i x_i$ [cm^3]	$A_i y_i$ $[cm^3]$
1. Semicírculo	$-\frac{4(6)}{3\pi}$= -2.55	6	$\frac{\pi(6)^2}{2} = 56.55$	-144	339.3
2. Triángulo (grande)	3	4	54	162	216
3. Rectángulo	-0.5	6	-30	15	-180
4. Triángulo (pequeño)	3	5	-9	-27	-45
Suma			71.55	6	330.3

$$\bar{x} = 0.084\ [cm]\ , \bar{y} = 4.62\ [cm]$$



4)

$$\overrightarrow{T_C} = T_C\left(-\tfrac{1}{3}\hat{i} + \tfrac{2}{3}\hat{j} + \tfrac{2}{3}\hat{k}\right), \quad \overrightarrow{T_D} = T_D\left(-\tfrac{2}{3}\hat{i} + \tfrac{1}{3}\hat{j} - \tfrac{2}{3}\hat{k}\right), \quad \vec{F} = -300\,\hat{k}$$

$$\sum \vec{F} = \bar{0}$$

$$\sum F_x = -\frac{1}{3}T_c - \frac{2}{3}T_D + O_x = 0$$

$$\sum F_y = \frac{2}{3}T_c + \frac{1}{3}T_D + O_y - 300 = 0$$

$$\sum F_Z = \frac{2}{3}T_c - \frac{2}{3}T_D + O_z = 0$$

$$\overrightarrow{M_1} = (1{,}0{,}0)\; x\; \overrightarrow{T_C} = -\frac{2}{3}T_C\hat{j} + \frac{2}{3}T_C\hat{k}$$

$$\overrightarrow{M_2} = (2{,}0{,}0)\; x\,\overline{T_D} = \frac{4}{3}T_D\hat{j} + \frac{2}{3}T_D\hat{k}$$

$$\overline{\mu_3} = (2{,}0{,}0)x\vec{F} = -600\,\hat{k}$$

$$\sum \overrightarrow{M_B} = \bar{0}$$

$$\sum M_{xx} = 0$$

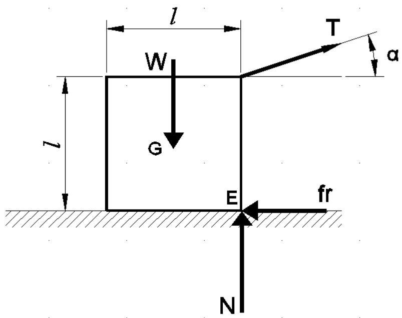
$$\sum M_{yy} = -\frac{2}{3}T_c + \frac{4}{3}T_D = 0$$

$$\sum M_{zz} = \frac{2}{3}T_c + \frac{2}{3}T_D - 600 = 0$$

Resolviendo el sistema;

$T_C = 600\ [N]$ $\qquad T_D = 300\ [N]$ $\qquad O = 489.90\ [N]$

5)



$$\sum F_x = Tcos\alpha - f_r = 0$$

$$\sum F_y = Tsen\alpha + N - W = 0$$

$$\sum M_E = \frac{l}{2}W - lTcos\alpha = 0$$

$$Tcos\alpha = \frac{1}{2}W$$

$$cos\alpha = \frac{W}{2T} \qquad \alpha = 36.87° \quad para\ que\ se\ vuelque$$

$$f_r = f_{rmax}$$

$$de \sum F_x \qquad f_r = 100\ [N]$$

$$f_{rmax} = \mu_s N = \mu_s (W - Tsen\alpha) = 100$$

$$\mu_s = \frac{100}{W - Tsen\alpha};\ \ \mu_s = 0.8$$