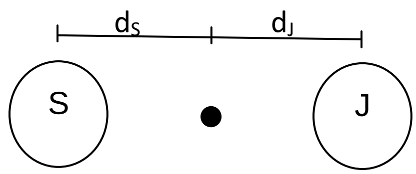
Solución al Primer Final de Estática (Matutino) Semestre: 2012-2

1) a)



igualando fuerzas

$F_S = G\frac{M_S m}{d_S^2} = G\frac{M_J m}{d_J^2} = F_J; \quad M_S d_S^2 = M_J d_J^2$

como

$d_S + d_J = 5.2, \quad d_S = 5.2 - d_J$

$\sqrt{M_S}d_J = \sqrt{M_J}(5.2 - d_J); \quad d_J = \frac{5.2\sqrt{M_J}}{\sqrt{M_S}+\sqrt{M_J}}$

distancia de ¨m¨ a Jupiter

$$d_J = 2.33x10^7\ [km]$$

b) $G\frac{M_J m}{R_J^2} = m g_J \quad g_J = G\frac{M_J}{R_J^2} = 15.13\ [\frac{m}{s^2}]$

2)

Vectores representativos

a) $\overrightarrow{F_1} = -6\hat{\imath} + 6\hat{\jmath} - 3\hat{k}\ [N] \quad \overrightarrow{F_2} = -6\hat{\imath} - 8\hat{\jmath}\ [N]$

Momento con respecto a Q

b) $\overrightarrow{r_{A/Q}} = (2,-1,-2) \quad \overrightarrow{M_1} = \overrightarrow{r_{A/Q}} x \overline{F_1} \quad \overrightarrow{M_1} = 15\hat{\imath} + 18\hat{\jmath} + 6\hat{k}\ [N \cdot m]$

$\overrightarrow{r_{D/Q}} = (-1,-5,-2) \quad \overrightarrow{M_2} = \overrightarrow{r_{D/Q}} x \overrightarrow{F_2} \quad \overrightarrow{M_2} = -16\hat{\imath} + 12\hat{\jmath} - 22\hat{k}\ [N \cdot m]$

$$\overrightarrow{M_Q} = \overrightarrow{M_1} + \overrightarrow{M_2}; \quad \overrightarrow{M_Q} = -\hat{\imath} + 30\hat{\jmath} - 16\hat{k}\ [N \cdot m]$$

c) $M_{eje} = \overrightarrow{M_2} \cdot \hat{u} \quad \hat{u} = \frac{1}{3}(2,2,1)$

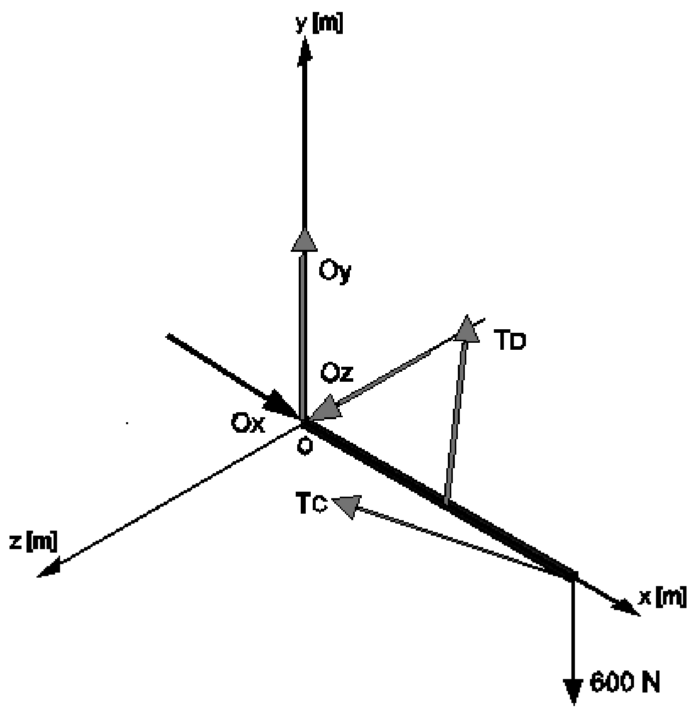
$\overrightarrow{M_{eje}} = -\frac{20}{3}\hat{\imath} - \frac{20}{3}\hat{\jmath} - \frac{10}{3}\hat{k}\ [N \cdot m]$

3)

Superficie	x_i [cm]	$y_i\ [cm]$	$A_i\ [cm^2]$	$A_i x_i$ [cm^3]	$A_i y_i\ [cm^3]$
Semicírculo (grande)	$\frac{4(2.25)}{3\pi} = 0.955$	2.25	$\frac{\pi(2.25)^2}{2} = 7.95$	7.59	17.89
Triángulo	-2	3	13.5	-27	40.5
Rectángulo	-1	3.5	-3	3	-10.5
Semicírculo (pequeño)	$-\left(2.5 + \frac{4(0.5)}{3\pi}\right) = -2.71$	3.5	$\frac{\pi(0.5)^2}{2} = -0.39$	1.06	-1.36
Suma			18.06	-15.35	46.53

$$\bar{x} = -0.85\ [cm]\ , \bar{y} = 2.57\ [cm]$$

4)



$$\overrightarrow{T_C} = T_C(-\frac{2}{3}\hat{i} + \frac{1}{3}\hat{j} + \frac{2}{3}\hat{k})$$

$$\overrightarrow{T_D} = T_D\left(-\frac{1}{3}\hat{i} + \frac{2}{3}\hat{j} - \frac{2}{3}\hat{k}\right)$$

$$\vec{F} = -600\ \hat{k}$$

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

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

$$\sum F_y = \frac{1}{3}T_c + \frac{2}{3}T_D + O_y - 600 = 0$$

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

$$\overrightarrow{\mathrm{M}_1} = (2{,}0{,}0)\ x\ \overrightarrow{\mathrm{T_C}} = -\frac{4}{3}T_C\hat{\jmath} + \frac{2}{3}T_C\hat{k}$$

$$\overrightarrow{\mathrm{M}_2} = (1{,}0{,}0)\ x\,\overline{T_D} = \frac{2}{3}T_D\hat{\jmath} + \frac{2}{3}T_D\hat{k}$$

$$\overrightarrow{\mathrm{M}_3} = (2{,}0{,}0)x\vec{\mathrm{F}} = -1200\ \hat{k}$$

$$\sum \overrightarrow{\mathrm{M_O}} = \bar{0}$$

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

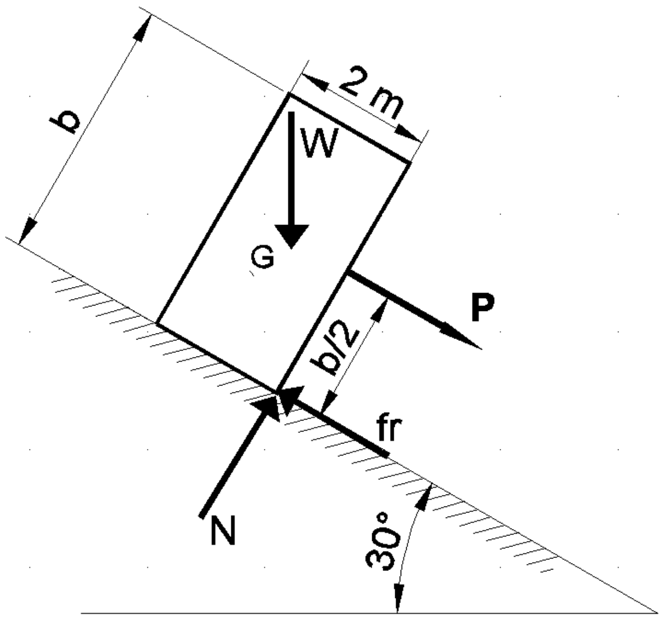
$$\sum M_{yy} = -\frac{4}{3}T_c + \frac{2}{3}T_D = 0$$

$$\sum M_{zz} = \frac{2}{3}T_c + \frac{2}{3}T_D - 1200 = 0$$

Resolviendo el sistema;

$T_C = 600\ [N]$ $T_D = 1200\ [N]$ $O = 979.80\ [N]$

5)



$$\sum F_x = P - f_r + \frac{1}{2}W = 0$$

$$\sum F_y = N - \frac{\sqrt{3}}{2}W = 0$$

$$f_{rmax} = \mu_s N = \frac{\sqrt{3}}{2}\mu_s W$$

$de\ \sum F_x,\qquad f_r = P + \frac{W}{2}\qquad en\ el\ limite\quad f_r = f_{rmax}$

$P + \frac{W}{2} = \frac{\sqrt{3}}{2}\mu_s W \qquad \longrightarrow \qquad \mu_s = \frac{\sqrt{3}}{2} = 0.86$

$para\ volcarse\qquad \sum M_G = -\frac{b}{2}f_r + N = 0$

$$b = \frac{2N}{f_r} = \frac{4}{\sqrt{3}} = 2.31[m]$$