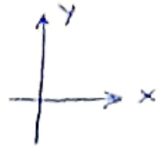
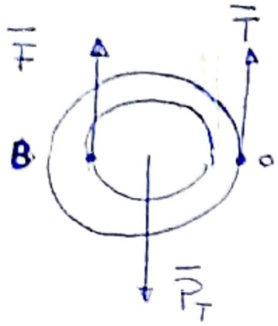
2°p - 1°C 2021

a) DCL

SR: Inercial

S.C





$$M_T = M + m = M + \frac{M}{2} = \frac{3M}{2}$$

$$I_{cm} = I_{cm}^D + I_{cm}^A = \frac{MR^2}{2} + mr^2$$

$$= \frac{MR^2}{2} + \frac{M}{2}\frac{R^2}{4} = \frac{5}{8} MR^2$$

$$\sum \overline{F} = M_T \overline{a}_{cm}$$

$$\sum \overline{M}_{cm} = I_{cm} \overline{\gamma}$$

y) $F + T - M_T g = M_T a_{cmy}$

$F + T - \frac{3}{2} Mg = \frac{3}{2} M a_{cmy}$ (I)

z) $RT - rF = I_{cm} \gamma$

$RT - \frac{R}{2} F = \frac{5}{8} MR^2 \gamma$

$T - \frac{F}{2} = \frac{5}{8} MR\gamma$ (II)

Vínculo

$$\overline{a}_{cm} = \overline{a}_o + \overline{\gamma} \times \overline{r}_{o\to cm} + \overline{\Omega} \times \overline{\Omega} \times \overline{r}_{o \to cm}$$

$\Rightarrow a_{cmy} \check{j} = \gamma \check{k} \times (-R)\check{i} = -\gamma R \check{j} \Rightarrow$ y) $a_{cmy} = -\gamma R$ (III)

(III) en (I) $\to$ $F + T - \frac{3}{2} Mg = -\frac{3}{2} MR\gamma$ (IV)

(IV) − (II) $\frac{3F}{2} - \frac{3}{2} Mg = -\frac{17}{8} MR\gamma$

$\Rightarrow \gamma = \frac{-12}{17} \frac{(F - Mg)}{R}$ y de (III) $\to a_{cmy} = \frac{12}{17}(F - Mg)$

Reemplazo en (II) $T = \frac{5}{8} MR \cdot \left(\frac{-12(F - Mg)}{17 R}\right) + \frac{F}{2}$

$\Rightarrow T = \frac{15}{34} Mg + \frac{1}{17} F$

$\circledast_1$ Se podía calcular γ con $\Sigma \bar{M}_0$

Steiner $I_0 = I_{cm} + M_T R^2 = \frac{5}{8} MR^2 + \frac{3}{2} MR^2 = \frac{17}{8} MR^2$

$$\Sigma \bar{M}_0 = I_0 \bar{\gamma}$$

z) $RM_T g - (R+r) F = I_0 \gamma$

$$\frac{3}{2} MRg - \frac{3}{2} FR = \frac{17}{8} MR^2 \gamma$$

$$\Rightarrow \gamma = \frac{12}{17} \frac{(Mg - F)}{MR}$$

Tema 1 $\quad F = \frac{3}{2} Mg$

a) $\bar{\gamma} = -\frac{12}{17} \frac{(F - Mg)}{R} \check{k} = -\frac{12}{17} \cdot \frac{(Mg/2)}{R} = \boxed{-\frac{6}{17} \frac{Mg}{R} \check{k}}$

$$T = \frac{15}{34} Mg + \frac{1}{17} F = \frac{15}{34} Mg + \frac{3}{34} Mg = \boxed{\frac{9}{17} Mg}$$

b) $\gamma < 0 \Rightarrow$ el conjunto sube $\quad d\bar{r}_{cm} = dr_{cm} \check{j}$

$$W^P = \int \bar{P} \cdot d\bar{r}_{cm} = \int_0^d - M_T g \check{j} \cdot dr_{cm} \check{j} = \boxed{-\frac{3}{2} Mgd}$$

$W^T = \boxed{\int \bar{T} \cdot d\bar{r}_o = 0}$ porque $o = CIR$

$$W^F = \int \bar{F} \cdot d\bar{r}_B = \int F \check{j} \cdot dr_B \check{j} =$$

$$= \int F \cdot dr_B = \int_0^d F \cdot \frac{3}{2} dr_{cm} =$$

$$= \frac{3}{2} F \cdot d = \boxed{\frac{9}{4} Mgd}$$

$\circledast_2$

Por rigidez

$dr_{cm} = d\theta R$

$dr_B = d\theta (R + r)$

$dr_B = d\theta \frac{3}{2} R$

$\Downarrow$

$dr_B = \frac{3}{2} dr_{cm}$

c) $\Delta E_m = \cancel{W^T} + W^F$ $\qquad$ $H=0$ en el instante inicial

$$M_T g d + \frac{I_O}{2}\Omega^2 = \frac{9}{4} Mgd$$

$$\frac{3}{2} Mgd + \frac{17}{16} MR^2\Omega^2 = \frac{9}{4} Mgd$$

$$\frac{17}{16}\cancel{M}R^2\Omega^2 = \frac{3}{4}\cancel{M}gd$$

$$|\Omega| = \sqrt{\frac{12}{17}\frac{gd}{R^2}}$$

$$\bar{V}_A = \cancel{\bar{V}_O} + \bar{\Omega} \times \bar{r}_{O\to A}$$

$$\bar{V}_A = -\Omega \breve{k} \times \left(-R\breve{i} - \frac{R}{2}\breve{j}\right)$$

$$\bar{V}_A = \Omega R \breve{j} - \frac{\Omega R}{2}\breve{i} = \sqrt{\frac{12}{17}gd}\,\breve{j} - \frac{1}{2}\sqrt{\frac{12}{17}gd}\,\breve{i}$$

Tema 2 $\quad F = \frac{1}{2} Mg$

a) $\bar{a}_{cm} = \frac{12}{17}(F - Mg)\breve{j} = -\frac{6}{17} Mg\,\breve{j}$

$$T = \frac{15}{34} Mg + \frac{1}{17} F = \frac{15}{34} Mg + \frac{1}{34} Mg = \frac{8}{17} Mg$$

b) $a_{cm} < 0 \Rightarrow$ el conjunto baja $\Rightarrow$ el cm va de O a $-d$

$$W^P = \int \bar{P}\cdot d\bar{r}_{cm} = \int_0^{-d} -M_T g\,\breve{j}\cdot(dr_{cm}\,\breve{j}) = \frac{3}{2} Mgd$$

$W^T = \int \bar{T}\cdot d\bar{r}_O = 0$ $\quad$ porque $O = CIR$

$$W^F = \int \bar{F}\cdot d\bar{r}_B = \int F\check{j}\cdot dr_B\check{j} = \int F\cdot dr_B =$$

$$= \int_0^{-d} F\cdot \frac{3}{2}\, dr_{cm} = \boxed{-\frac{3}{4} Mgd}$$

Por $\mathcal{B}_2$

$$dr_B = \frac{3}{2}\, dr_{cm}$$

c)

$$\Delta E_m = \cancel{W^T} + W^F$$

$H=0$ en el instante inicial

$$M_T g\cdot(-d) + \frac{1}{2} I_O \Omega^2 = W^F$$

$$-\frac{3}{2} Mgd + \frac{17}{16} MR^2\Omega^2 = -\frac{3}{4} Mgd$$

$$\frac{17}{16} \cancel{M} R^2\Omega^2 = \frac{3}{4} \cancel{M} gd$$

$$|\Omega| = \sqrt{\frac{12}{17}\frac{gd}{R^2}}$$

$$\bar{V}_A = \cancel{\bar{V}_O} + \bar{\Omega} \times \bar{r}_{O\to A}$$

$$\bar{V}_A = \Omega\check{k} \times (-R\check{i} + R\check{j})$$

$$\bar{V}_A = -\Omega R\check{j} - \Omega R\check{i} = \boxed{-\sqrt{\frac{12}{17}gd}\,\check{i} - \sqrt{\frac{12}{17}gd}\,\check{j}}$$