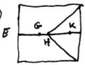
1) 

$EH = \frac{a}{2} \qquad EK = \frac{a}{2} + \frac{2}{3}\frac{a}{2} = \frac{5}{6}a \qquad M^Q = 4m \qquad M^T = m$

$EG = \dfrac{4m\ EH - m\, EK}{4m - m} = \frac{1}{3}\left(4\cdot\frac{a}{2} - \frac{5}{6}a\right) = \frac{7}{18}a$

$GH = EH - EG = \frac{1}{9}a \qquad GK = EK - EG = \frac{4}{9}a$

$\underset{G}{I}{}^{Q}_{ij} = dg\left(\frac{ma^2}{3}, \frac{ma^2}{3}, \frac{2}{3}ma^2\right) + dg\left(0, \frac{4ma^2}{81}, \frac{4ma^2}{81}\right) = dg\left(\frac{1}{3}, \frac{31}{81}, \frac{58}{81}\right)ma^2$

$\underset{G}{I}{}^{T}_{ij} = dg\left(\frac{ma^2}{24}, \frac{ma^2}{72}, \frac{ma^2}{18}\right) + dg\left(0, \frac{16ma^2}{81}, \frac{16ma^2}{81}\right) = dg\left(\frac{1}{24}, \frac{137}{648}, \frac{41}{162}\right)ma^2$

$\underset{G}{I}{}^{lam}_{ij} = \underset{G}{I}{}^{Q}_{ij} - \underset{G}{I}{}^{T}_{ij} = dg\left(\frac{7}{24}, \frac{37}{216}, \frac{25}{54}\right)ma^2$

2) $T = \frac{1}{2}3m v_G^2 + \frac{1}{2}\bar{\omega}\cdot \underset{G}{I}{}^{lam}(\bar{\omega})$

$\bar{\omega} = \dot{\theta}\bar{e}_2 \qquad \bar{x}_G = \frac{7}{18}a\cos\theta\,\bar{e}_1 + \frac{7}{18}a\,\mathrm{sen}\,\theta\,\bar{e}_2 - \left(s + \frac{a}{2}\right)\bar{e}_3$

$\bar{v}_G = -\frac{7}{18}a\,\mathrm{sen}\,\theta\,\dot{\theta}\,\bar{e}_1 + \frac{7}{18}a\cos\theta\,\dot{\theta}\,\bar{e}_2 - \dot{s}\,\bar{e}_3 \qquad v_G^2 = \frac{49}{324}a^2\dot{\theta}^2 + \dot{s}^2$

$T = \frac{3}{2}m\left(\frac{49}{324}a^2\dot{\theta}^2 + \dot{s}^2\right) + \frac{1}{2}\underset{G}{I}{}^{lam}_{22}\dot{\theta}^2 = \frac{m}{2}\left(3\dot{s}^2 + \frac{5}{8}a^2\dot{\theta}^2\right)$

$V = \frac{K}{2}(OA)^2 + 3mg\,z_G - F y_H = \frac{K}{2}s^2 - 3mg s - \cancel{3mg\frac{a}{2}} - \frac{Fa}{2}\,\mathrm{sen}\,\theta$

$L = T - V = \frac{3m}{2}\dot{s}^2 + \frac{5ma^2}{16}\dot{\theta}^2 - \frac{K}{2}s^2 + 3mg s + \frac{Fa}{2}\,\mathrm{sen}\,\theta$

$3m\ddot{s} + Ks - 3mg = 0$

$\frac{5}{8}ma^2\ddot{\theta} - \frac{Fa}{2}\cos\theta = 0$

3) $V_s = Ks - 3mg \qquad V_\theta = -\frac{Fa}{2}\cos\theta \qquad$ equilibrio $\quad s = \frac{3mg}{K} \qquad \theta = \pm\frac{\pi}{2}$

$V_{ss} = K > 0 \qquad V_{\theta\theta} = \frac{Fa}{2}\,\mathrm{sen}\,\theta \qquad V_{s\theta} = 0$

$V_{\theta\theta}\left(\frac{\pi}{2}\right) > 0$ eq. stabile $\qquad V_{\theta\theta}\left(-\frac{\pi}{2}\right) < 0$ eq. instabile

4) $\bar{\phi}_A + \bar{\phi}_B + \bar{F} + K(O-A) + 3m\bar{g} = 0 \qquad \bar{\phi}_A + \bar{\phi}_B + F\bar{e}_2 + \underbrace{(Ks - 3mg)}_{=0 \text{ all'equilibrio}}\bar{e}_3 = 0$

$(B-A)\wedge\bar{\phi}_B + (H-A)\wedge\bar{F} + (G-A)\wedge 3m\bar{g} = 0$

Per $\theta = \frac{\pi}{2}$, $\quad B - A = -a\bar{e}_3 \qquad H - A = \frac{a}{2}\bar{e}_2 - \frac{a}{2}\bar{e}_3 \qquad G - A = \frac{7a}{18}\bar{e}_2 - \frac{a}{2}\bar{e}_3$

$-a\,\bar{e}_3\wedge(\phi_{B1}\bar{e}_1 + \phi_{B2}\bar{e}_2) + \frac{a}{2}(\bar{e}_2 - \bar{e}_3)\wedge F\bar{e}_2 + \left(\frac{7a}{18}\bar{e}_2 - \frac{a}{2}\bar{e}_3\right)\wedge(-3mg\,\bar{e}_3) = 0$

$-\phi_{B1}\bar{e}_2 + \phi_{B2}\bar{e}_1 + \frac{F}{2}\bar{e}_1 - \frac{7}{6}mg\,\bar{e}_1 = 0 \qquad \phi_{B1} = 0 \qquad \phi_{B2} = \frac{7}{6}mg - \frac{F}{2}$

$\bar{\phi}_A = -\bar{\phi}_B - F\bar{e}_2 = \left(-\frac{7}{6}mg + \frac{F}{2} - F\right)\bar{e}_2 = -\left(\frac{7}{6}mg + \frac{F}{2}\right)\bar{e}_2$