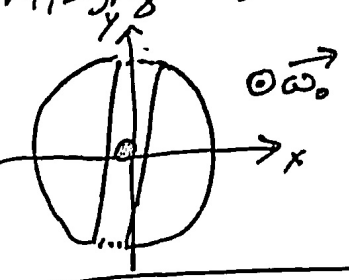
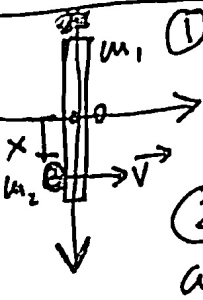
$m_1 = 9\,kg$ $m_2 = 1.5\,kg$ $\omega_0 = \frac{9}{5}\,rad/s$



conservazione momento angolare

$L_0 = I\omega_0 = \frac{m_1 r^2}{2}\omega_0 = L_1 = \frac{m_1 r^2}{2}\omega + m_2 r^2 \omega$

$\frac{m_1 r^2 \omega_0}{2} = r^2\omega\left(\frac{m_1}{2} + m_2\right)$ $\omega = \frac{m_1\omega_0}{m_1 + 2m_2} = \frac{\frac{9}{5}}{3}\,\frac{rad}{s} = 4.5\,\frac{rad}{5}$



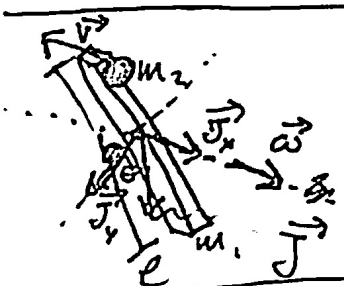
① $m_2 V = (m_1 + m_2)V_{cm}$ $V_{cm} = \frac{m_2}{m_1+m_2}V$ $r_{cm} = \frac{x m_2}{m_1+m_2}$

$(x - r_{cm})m_2 V = I\omega = \left(\frac{m_1\ell^2}{12} + r_{cm}^2 m_1 + m_2(x - r_{cm})^2\right)\omega$ $\omega = \frac{(x - r_{cm})m_2 V}{I}$

② $m_1 = m_2 = m$ $x = \ell$ $r_{cm} = \frac{\ell}{2}$

$r_{cm} m V = I\omega = \left(\frac{m\ell^2}{12} + m r^2\right)\omega$

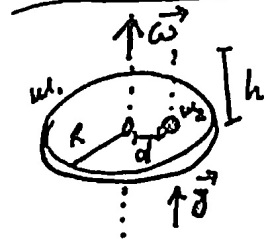
$\omega = \frac{r V}{\frac{\ell^2}{12} + r^2}$ $J = \Delta p = m\omega r - mV$



$J_x = \Delta p_x = -m_2 V$

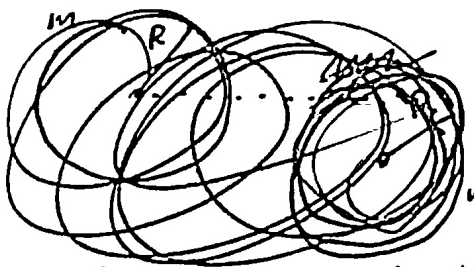
$I\omega = I'\omega'$ $\frac{m_1\ell^2}{12}\omega = \left(\frac{m_1\ell^2}{12} + \frac{m_2\ell^2}{4}\right)\omega'$ $\omega' = \frac{m_1\omega}{m_1 + 3m_2}$

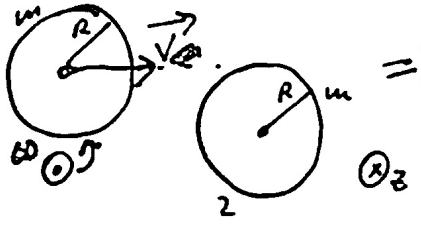
$J_y = \Delta p_y = m_2\omega'\frac{\ell}{2}$ $J = \sqrt{J_x^2 + J_y^2}$ $\theta = \arcsin\frac{J_x}{J}$



$I_0\omega = I_1\omega'$ $\frac{1}{2}m_1 R^2\omega = \left(\frac{1}{2}m_1 R^2 + m_2 d^2\right)\omega'$ $\omega' = \frac{m_1 R^2\omega}{m_1 R^2 + 2m_2 d^2}$

$J_y = m_2\sqrt{2gh}$ Impulso angolare $= J_y d$





1: m, R, $V = V$, $\omega = 0$

2: m, R, $V = 0$ $\omega = 0$

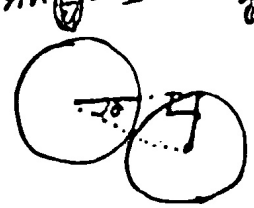
1,2: C.M. $\equiv O$, $V = V_{cm}$, $\omega =$

$V = 2V_{cm}$ $V_{cm} = \frac{V}{2}$

Polo: O $L_i = RmV\sin\theta - I\omega = RmV\sin\theta - \frac{1}{2}mR^2\omega$

$L_f = 0$ $\Rightarrow RmV\sin\theta = \frac{mR^2\omega}{2}$ $\omega = \frac{2V\sin\theta}{R}$

$\omega = \frac{V}{R}$

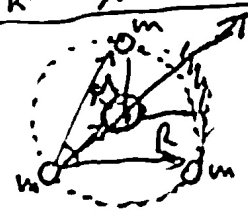


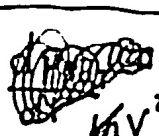
$2R\sin\theta = R$

$\sin\theta = \frac{1}{2}$

$\theta = \frac{\pi}{6}$

$\frac{GM}{R^2} = \frac{V^2}{R}$ $T = \frac{2\pi R}{V}$ $T^2 = \frac{4\pi^2 R^2}{V^2} = \frac{4\pi^2}{GM}R^3$





$P = mV_{cm} = 0$ $L = 3RmV_m$

$\frac{mV^2}{R} = \frac{GMm}{R^2} + \frac{2Gm^2}{(2R\sin\frac{\pi}{3})^2} = \frac{GMm}{R^2} + \frac{2Gm^2}{3R^2}$ $V_m = \sqrt{\frac{G}{R}\left(M + \frac{2}{3}m\right)}$

$T = \frac{2\pi r}{V_m}$

$E_p = 0$ $\frac{1}{\mu} = \frac{1}{M} + \frac{3}{m} = \frac{m+3M}{Mm}$ $\mu = \frac{Mm}{m+3M}$ $E_p = -3\frac{GMm}{R} + 3\frac{Gm^2}{R\sqrt{3}}$