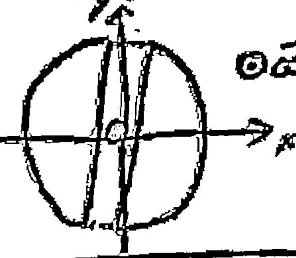
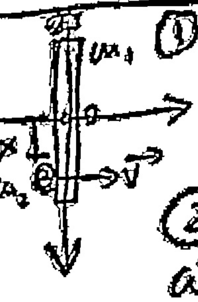
$m_1 = 3 kg$ ...

conservazione momento angolare



$\odot \vec{\omega}_0 \quad L_0 = I\omega_0 = \frac{m_1 r^2}{2}\omega_0 = L_1 = \frac{m_1 r^2}{2}\omega + m_2 r^2 \omega$

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



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

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

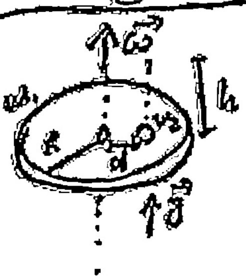
② $m_1 = m_2 = m \quad x = r \quad r m v = I\omega = \left(\frac{m\ell^2}{12} + m r^2\right)\omega$

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

$J_x = \Delta p_x = -m_2 v$

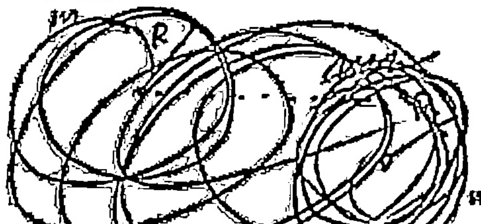
$I\omega = I'\omega' \quad \frac{m_1 \ell^2}{12}\omega = \left(\frac{m_1 \ell^2}{12} + \frac{m_2 \ell^2}{4}\right)\omega' \quad \omega' = \frac{m_1 \omega}{m_1 + 3m_2}$

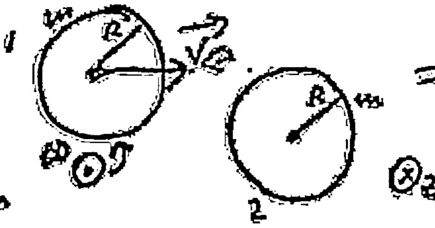
$J_y = \Delta p_y = m_2 \omega \frac{\ell}{2} \quad J = \sqrt{J_x^2 + J_y^2} \quad \theta = \arcsin \frac{J_x}{J}$



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

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



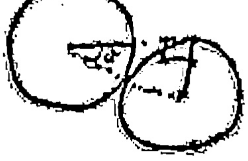


1: $m, R, v = v, \omega = 0$
2: $m, R, v = 0, \omega = 0$
1 2: CM $\equiv$ O, $v = V_{cm}, \omega$ ...

$m v = 2m V_{cm} \quad V_{cm} = \frac{v}{2} \quad$ Polo: O $\quad L_i = R m v \sin\theta - I\omega = \sin\theta R m v - \frac{1}{2} m R^2 \omega$

$L_f = 0 \quad \Rightarrow \sin\theta R m v = \frac{m R^2 \omega}{2} \quad \omega = \frac{2 v \sin\theta}{R}$

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



$2 R \sin\theta = R$
$\sin\theta = \frac{1}{2}$
$\theta = \frac{\pi}{6}$

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

$P = m V_{cm} = 0 \quad L = 3 R m V_m$

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

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

$E_{p0} \quad \frac{1}{\mu} = \frac{1}{M} + \frac{3}{m} = \frac{m + 3M}{Mm} \quad \mu = \frac{Mm}{m + 3M} \quad E_{p0} = -3\frac{GMm}{R} - 3\frac{Gm^2}{\sqrt{3}R}$