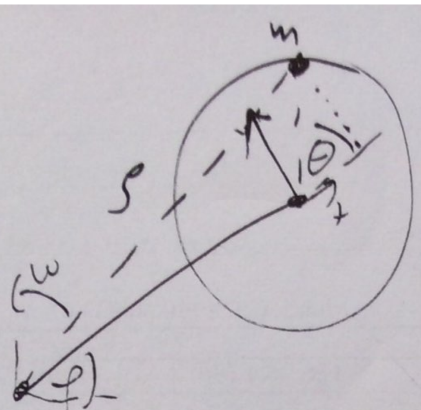
#1)



$$V_{cf} = -\frac{1}{2} m\omega^2\rho^2$$

$$V_{cor} = 2m\omega\, r v_\theta$$

4.) $x = r\cos\theta \qquad \dot{x} = -r\sin\theta\dot\theta$

$y = r\sin\theta \qquad \dot{y} = r\cos\theta\dot\theta$

5.) $T = \frac{1}{2}m(\dot{x}^2+\dot{y}^2) = \frac{1}{2}m r^2\dot\theta^2$

$$V = V_{cf} + V_{cor} = -\frac{1}{2}m\omega^2\rho^2 + \cancel{2m\omega r v_\theta} = -\frac{1}{2}m\omega^2\left[(R + r\cos\theta)^2 + r^2\sin^2\theta\right] + \cancel{2m\omega r\dot\theta}$$

$$L = T - V = \frac{1}{2}m r^2\dot\theta^2 + \frac{1}{2}m\omega^2\left[(R+r\cos\theta)^2 + r^2\sin^2\theta\right] - \cancel{2m\omega r\dot\theta} =$$

$$= \frac{1}{2}m\left[r^2\dot\theta^2 + \omega^2R^2 + \omega^2r^2\cos^2\theta + 2\omega^2 rR\cos\theta + \omega^2r^2\sin^2\theta - \cancel{4\omega r\dot\theta}\right] =$$

$$= \frac{1}{2}m\left[r^2\dot\theta^2 + \omega^2R^2 + \omega^2r^2 + 2\omega^2 rR\cos\theta - \cancel{4\omega r\dot\theta}\right]$$

$$\cancel{4m\,R\,\omega r\dot\theta\cos\theta}$$

$$\cancel{2m\omega r\dot\theta\,\rho\ \ -2m\omega r\dot\theta\,(R + r\cos\theta)^2 + r^2\sin^2\theta}$$

6.) $\frac{\partial L}{\partial\theta} = \frac{1}{2}m\,2\omega^2 rR\sin\theta = -m\omega^2 rR\sin\theta$

$\frac{\partial L}{\partial\dot\theta} = mr^2\dot\theta \xrightarrow{d/dt} \frac{d}{dt}\frac{\partial L}{\partial\dot\theta} = mr^2\ddot\theta$

$$r\ddot\theta = \omega^2 R\sin\theta$$

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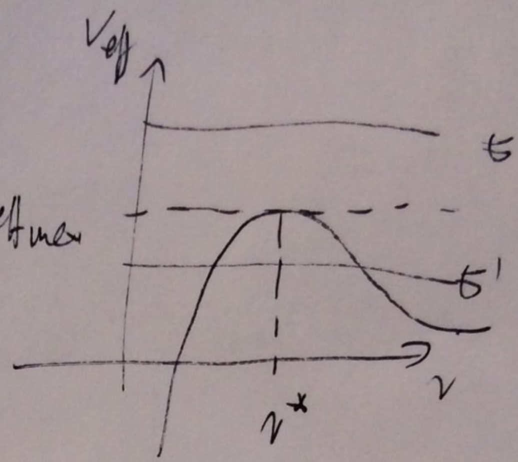
#2)

a) $V_{eff}(r) = \frac{N^2}{2mr^2} - \frac{C}{3r^3}$

$V'_{eff}(r) = -\frac{N^2}{mr^3} + \frac{C}{r^4}$

$V'_{eff}(r^*) = -\frac{N^2}{mr^{*3}} - \frac{C}{r^{*4}} = 0$

$r^* = \frac{mC}{N^2}$



$$V_{eff_{max}}(r_*) = \frac{N^2}{2m\frac{m^2C^2}{N^4}} - \frac{C}{3\frac{m^3C^3}{N^6}} = \frac{N^6}{2m^3C^2} - \frac{N^6}{3m^3C^2} = \underline{\underline{\frac{N^6}{6m^3C^2}}}$$

b) Feltétel $E > V^{eff}_{max}$

$N = m v_0 b$

Tudjuk $E = E_\infty = \frac{1}{2} m v_0^2$

$$\frac{(mv_0b)^6}{6m^3C^2} < \frac{1}{2} m v_0^2 \Rightarrow b < \underline{\underline{\left(\frac{3C^2}{m^2v_0^4}\right)^{1/6}}} \equiv b_{max}$$