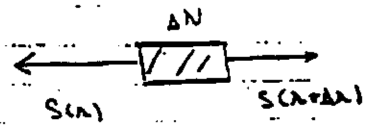
1

a) 

Differensen mellom S(x) og S(x+Δx) må gi sentripetalakselerasjonen

$$S(x) - S(x+\Delta x) = -\Delta S = \Delta m\, x\, \omega^2 = m \frac{\Delta x}{a} x \omega^2 \Rightarrow$$

$$\underline{\Delta S = -\frac{m\omega^2}{a} x \Delta x}$$

$S(x) > S(x+\Delta x)$: S avtar utover.

b) $\Delta x \to dx \Rightarrow$

$$dS = -\frac{m\omega^2}{a} x\, dx \qquad S = -\frac{m\omega^2}{2a} x^2 + K$$

Grensebet.: $x = a \Rightarrow \underline{S(a) = Ma\omega^2} \Rightarrow K = (M + \frac{m}{2}) a\omega^2$

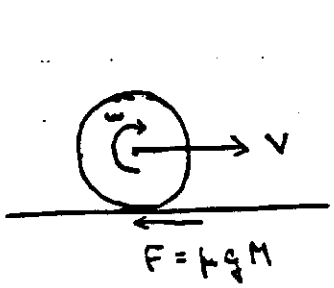
$$S = (M + \frac{m}{2}) a\omega^2 - \frac{m\omega^2}{2a} x^2 = \underline{\underline{\omega^2 a \left[M + \frac{m}{2}\left(1 - \frac{x^2}{a^2}\right)\right]}}$$

$m \ll M \qquad S \approx M\omega^2 a \approx$ konst. Spenn til enhver snor.

$\underline{S \text{ størst for } x = 0} \qquad \underline{S_{max} = \omega^2 a (M + \frac{m}{2})}$

2/

a) Linear led:



$$M\frac{dV}{dt} = -F = -\mu_q M$$

Rotation:

$$I\frac{d\omega}{dt} = FR = \mu_q MR \qquad I = \tfrac{2}{5}MR^2 \Rightarrow$$

$$\underline{\underline{\frac{dV}{dt} = -\mu_q}} \qquad \underline{\underline{\frac{d\omega}{dt} = \frac{5}{2}\frac{\mu_q}{R}}}$$

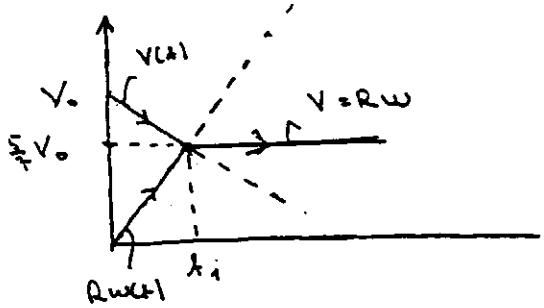
Integration med q.v. $V(0) = V_0 \quad \omega(0) = 0 \Rightarrow$

$$\underline{\underline{V = V_0 - \mu_q t}} \qquad \underline{\underline{\omega = \frac{5}{2}\frac{\mu_q}{R}t}} \qquad (V > \omega R).$$

↙

Avtar linear med t — Ökar linear med t

b) Rullning för $t > t_1$



där $R\omega(t_1) = V(t_1)$

$$\frac{5}{2}\mu_q t_1 = V_0 - \mu_q t_1 \Rightarrow$$

$$\underline{\underline{t_1 = \frac{2}{7}\frac{V_0}{\mu_q}}}$$

$$V_1 = \omega_1 R = V_0 - \tfrac{2}{7}V_0 = \underline{\underline{\tfrac{5}{7}V_0}}$$

$$K_0 = \tfrac{1}{2}MV_0^2$$

$$K_1 = \tfrac{1}{2}MV_1^2 + \tfrac{1}{2}I\omega_1^2 \rightarrow \tfrac{5}{7}K_0$$

$$\Delta K = \tfrac{2}{7}K_0 \qquad \underline{\underline{\Delta K/K_0 = 2/7}}$$