

Lösningar 5C1101 28/5 2004



Sätt $x=0$ och $t=0$ då bilen kör om.

Bilen: $x_1 = v_1 t$

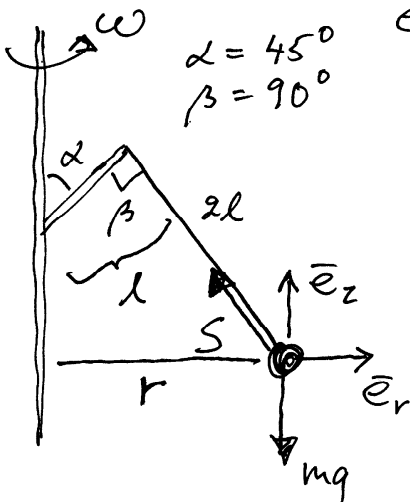
Motorcykeln: $x_2 = \frac{1}{2} a_2 t^2 + v_2 t$

Motorcykeln hinner ikapp då $x_1(t_1) = x_2(t_1)$

$$\Rightarrow v_1 t_1 = \frac{1}{2} a_2 t_1^2 + v_2 t_1 \Rightarrow t_1 = \frac{2(v_1 - v_2)}{a_2}$$

Motorcykeln har då kört $s = x_1(t_1) =$
 $= \frac{2v_1(v_1 - v_2)}{a_2}$

2)



$$\left. \begin{aligned} \bar{e}_z: \frac{1}{\sqrt{2}} S - mg &= 0 \\ \bar{e}_r - mr\dot{\theta}^2 &= -\frac{1}{\sqrt{2}} S \end{aligned} \right\} \Rightarrow$$

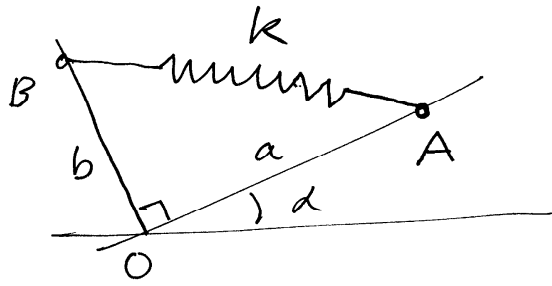
$$mr\dot{\theta}^2 = mg$$

$$\dot{\theta} = \omega$$

$$r = \frac{1}{\sqrt{2}} l + \frac{1}{\sqrt{2}} 2l = \frac{3l}{\sqrt{2}}$$

$$\omega = \sqrt{\frac{g}{\frac{3l}{\sqrt{2}}}} = \sqrt{\frac{\sqrt{2}g}{3l}}$$

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$$T_A + V_A = T_0 + V_0$$

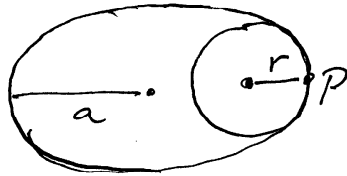
$$T_A = T_0 + V_0 - V_A = \frac{1}{2} m v_0^2 - m g a \sin \alpha - \frac{1}{2} k (\Delta l)^2$$

Där $\Delta l = \sqrt{b^2 + a^2} - b$ är fjäderns förlängning

$$\frac{1}{2} m v_A^2 = \frac{1}{2} m v_0^2 - m g a \sin \alpha - \frac{1}{2} k (\Delta l)^2 \Rightarrow$$

$$v_A = \sqrt{v_0^2 - 2 g a \sin \alpha - \frac{k}{m} (\sqrt{b^2 + a^2} - b)^2}$$

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Keplers tredje lag:

$$T_A = 2\pi \frac{r^{3/2}}{\sqrt{GM}}$$

$$T_B = 2\pi \frac{a^{3/2}}{\sqrt{GM}}$$

Banorna tangeras varandra i P: $r = r_p$

$$r_p = a(1-e) \Rightarrow a = \frac{r}{(1-e)}$$

$$\frac{T_A}{T_B} = \left(\frac{r}{a}\right)^{3/2} = (1-e)^{3/2}$$