22) $L = \frac{I_a}{2}\left(\dot{\Phi}^2 \sin^2\Theta + \dot{\Theta}^2\right) + \frac{I_c}{2}\left(\dot{\Phi}\cos\Theta + \dot{\Psi}\right)^2 - gml\cos\Theta$

$\frac{\partial L}{\partial \dot{\Theta}} = (I_a \dot{\Theta}) \quad \frac{d}{dt}(\dots) = I_a \ddot{\Theta}$

$\frac{\partial L}{\partial \Theta} = \dot{\Phi}^2 \sin\Theta\cos\Theta(I_a - I_c) - I_c\dot{\Phi}\dot{\Psi}\sin\Theta + mgl\sin\Theta$

I $\quad I_a\ddot{\Theta} - \dot{\Phi}^2\sin\Theta\cos\Theta(I_a - I_c) + I_c\dot{\Phi}\dot{\Psi}\sin\Theta - mgl\sin\Theta = 0$

keine Nutation $\Rightarrow \Theta = \text{const}, \ \dot{\Theta} = \ddot{\Theta} = 0$

$\Rightarrow \dot{\Phi}^2\cos\Theta(I_a - I_c) - I_c\dot{\Phi}\dot{\Psi} + mgl = 0$ $\quad$ $I_A = I_c$

$\Leftrightarrow \quad \dot{\Phi}^2 - \frac{I_c\dot{\Psi}}{(I_a - I_c)\cos\Theta}\dot{\Phi} + \frac{mgl}{\cos\Theta(I_a - I_c)} = 0$

pq-Formel: $\dot{x} = \dot{\Phi} \quad y = \dot{\Psi}$

$$\dot{x}_{1/2} = \frac{I_c}{2(I_a - I_c)\cos\Theta}\, y \pm \sqrt{\frac{I_c^2}{(I_a - I_c)^2\cos^2\Theta \cdot 4}\, y^2 - \frac{mgl}{\cos\Theta(I_a - I_c)}}$$

NR: $\frac{I_c^2 y^2}{(I_a - I_c)^2\cos^2\Theta \cdot 4} - \frac{mgl}{\cos\Theta(I_a - I_c)}$

$$= \frac{I_c^2 y^2 - mgl \cdot 4\cos\Theta(I_a - I_c)}{4(I_a - I_c)^2\cos^2\Theta}$$

$$x_{1/2} = \underbrace{\frac{I_c}{2(I_a - I_c)\cos\Theta}}_{C}\left(y \pm \sqrt{y^2 - \frac{4mgl\cos\Theta(I_a - I_c)}{I_c^2}}\right)$$

$$= C\left(y \pm \sqrt{y^2 - \frac{4mgl\cos\Theta(I_a - I_c)}{I_c^2}}\right)$$

$=$