Cálculo da integral elíptica

$$T=\sqrt{\frac{2l}{g}}\int_{-\theta_0}^{\theta_0}\frac{d\theta}{\sqrt{\cos\theta-\cos\theta_0}}=\underbrace{\boxed{\sqrt{\frac{2l}{g}}\int_{-\theta_0+\varepsilon}^{\theta_0+\varepsilon}\frac{d\theta}{\sqrt{\cos\theta-\cos\theta_0}}}}_{=N}$$

numerica// avaliado

$$+\underbrace{\sqrt{\frac{2l}{g}}\int_{-\theta_0}^{-\theta_0+\varepsilon}\frac{d\theta}{\sqrt{\cos\theta-\cos\theta_0}}}_{A}+\underbrace{\sqrt{\frac{2l}{g}}\int_{\theta_0-\varepsilon}^{\theta_0}\frac{d\theta}{\sqrt{\cos\theta-\cos\theta_0}}}_{B}$$

analítico analítico

$= N+2A$ pois $\theta\to-\theta \Rightarrow A=B$

$$A=\sqrt{\frac{2l}{g}}\int_{-\theta_0}^{-\theta_0+\varepsilon}\frac{d\theta}{\sqrt{\cos\theta-\cos\theta_0}}$$ $\longleftarrow$ θ próximo de $-\theta_0$

$\theta=-\theta_0+\varphi$ φ pequeno

$$\cos\theta-\cos\theta_0=\cos(-\theta_0+\varphi)=\cancel{\cos\theta_0}\overset{\approx 1}{\cos\varphi}+\operatorname{sen}\theta_0\overset{\approx\varphi}{\operatorname{sen}\varphi}-\cancel{\cos\theta_0}$$

$\approx \operatorname{sen}\theta_0\cdot\varphi$,

$$A=\sqrt{\frac{2l}{g}}\int_0^{\varepsilon}\frac{1}{\sqrt{\operatorname{sen}\theta_0}}\frac{1}{\sqrt{\varphi}}d\varphi=\underbrace{2\sqrt{\frac{2l}{g}}\frac{1}{\sqrt{\operatorname{sen}\theta_0}}\sqrt{\varepsilon}}_{\text{adicionar ao numérico}}$$