$$\frac{\partial \mathcal{L}}{\partial x} = mg\sin\alpha - \frac{1}{2}mg\cos\alpha\,(1-\cos\theta)\left(\frac{\frac{x}{l}+\sin\varphi_{10}}{\sqrt{1-\left(\frac{x}{l}+\sin\varphi_{10}\right)^2}} + \frac{\frac{x}{l}+\sin\varphi_{20}}{\sqrt{1-\left(\frac{x}{l}+\sin\varphi_{20}\right)^2}}\right)$$

$$+\frac{k}{l}\left(\frac{\beta-\arcsin\left(\frac{x}{l}\sin\varphi_{10}\right)}{\sqrt{1-\left(\frac{x}{l}+\sin\varphi_{10}\right)^2}} + \frac{\beta-\arcsin\left(\frac{x}{l}\sin\varphi_{20}\right)}{\sqrt{1-\left(\frac{x}{l}+\sin\varphi_{20}\right)^2}} + \frac{\left(-\beta+\arccos\left(\sqrt{1-\left(\frac{x}{l}+\sin\varphi_{10}\right)^2}\right)+\frac{x}{l}\tan\theta\right)\left(-\frac{\frac{x}{l}\sin(\varphi_{10})}{\sqrt{1-\left(\frac{x}{l}+\sin\varphi_{10}\right)^2}}+\tan\theta\right)}{\sqrt{1-\left(\sqrt{1-\left(\frac{x}{l}+\sin\varphi_{10}\right)^2}+\frac{x\tan\theta}{l}\right)^2}}\right)$$

$$-\frac{1}{4}ml\left(\frac{\frac{x}{l}\sin\varphi_{10}}{\sqrt{1-\left(\frac{x}{l}+\sin\varphi_{10}\right)^2}} + \frac{\frac{x}{l}\sin\varphi_{20}}{\sqrt{1-\left(\frac{x}{l}+\sin\varphi_{20}\right)^2}}\right)\left(\sqrt{1-\left(\frac{x}{l}+\sin\varphi_{10}\right)^2}+\sqrt{1-\left(\frac{x}{l}+\sin\varphi_{20}\right)^2}\right)$$