$$\frac{\mathrm{d}x}{\mathrm{d}t} = U + \frac{p}{k}\sqrt{\frac{g}{k}} \qquad\qquad \frac{\mathrm{d}y}{\mathrm{d}t} = \frac{q}{k}\sqrt{\frac{g}{k}}$$

$$\frac{\mathrm{d}p}{\mathrm{d}t} = 0 \qquad\qquad\qquad\quad \frac{\mathrm{d}q}{\mathrm{d}t} = 0$$