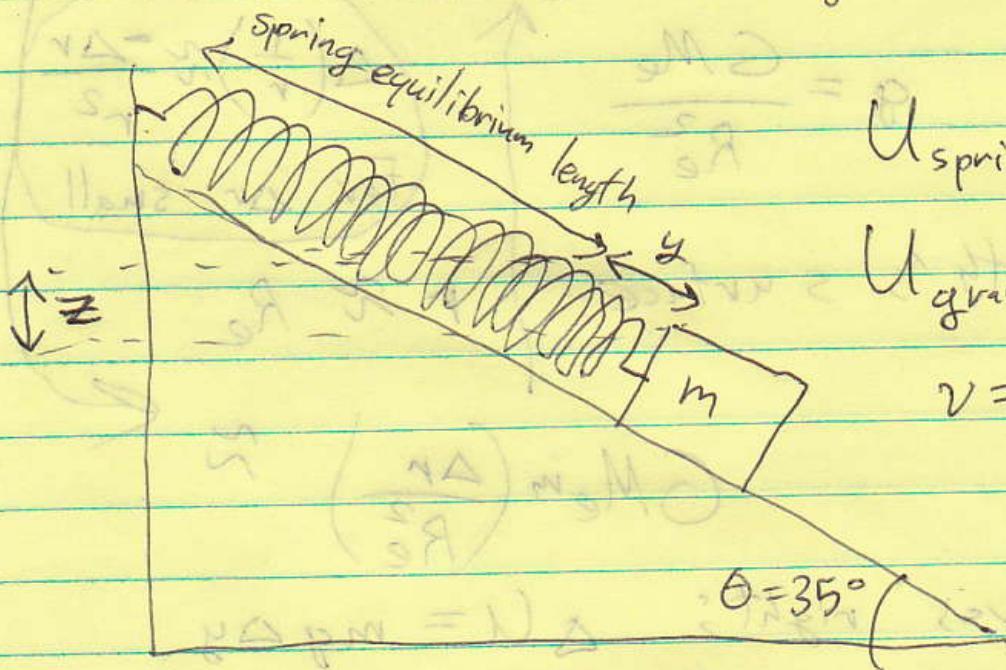


of 5.0 kg
 A mass m slides along a ramp with
 a 35° angle of elevation. It is
 connected to a spring that goes to
 the top of the ramp. The
 spring has spring constant $k_0 = 2.0 \text{ kg/s}^2$.

What is the period T of
 oscillation of the sliding mass?
 Same as J/m^2



$$U_{\text{spring}} = \frac{1}{2} k_0 y^2$$

$$U_{\text{gravity}} = -mgz$$

$$v = \frac{dy}{dt} \quad K = \frac{1}{2} mv^2$$

$$U = U_{\text{spring}} + U_{\text{gravity}}$$



$$\sin \theta = \frac{y}{z} \quad z = \frac{y}{\sin \theta}$$

$$U = \frac{1}{2} k_0 y^2 - mg \left(\frac{y}{\sin \theta} \right) = \frac{k_0 y^2}{2} - \frac{mgy}{\sin \theta}$$

~~Find the equilibrium pos~~

$$\frac{dU}{dy} = k_0 y - \frac{mg}{\sin\theta} \quad \frac{d^2U}{dy^2} = k_0 \text{ (everywhere)}$$

$$\Rightarrow \left(\frac{d^2U}{dy^2} \text{ at the equilibrium } y\text{-position} \right) = k_0$$

~~near eq~~ $\Rightarrow U = \frac{1}{2} k x^2$

where $k = k_0$ and x is displacement from equilibrium.

$$T = \frac{1}{2\pi} \sqrt{\frac{m}{k}} = \frac{1}{2\pi} \sqrt{\frac{m}{k_0}} = \frac{1}{2\pi} \sqrt{\frac{5.0 \text{ kg}}{2.0 \text{ kg/s}^2}}$$

$$T = 0.25 \text{ s}$$

Observe that T does not depend on the ~~the~~ angle of the ramp, the initial position or initial velocity of the mass, nor the gravitational field strength.

Only the spring's constant ~~and~~ and the mass affect T in this example.