

Period of a Pendulum The period T (in seconds) of a simple pendulum as a function of its length l (in feet) is given by¹

$$T(l) = 2\pi\sqrt{\frac{l}{32.2}}$$

- (a) Express the length l as a function of the period T .

Here we need to solve for l in terms of T .

$$\begin{aligned}T &= 2\pi\sqrt{\frac{l}{32.2}} \\ \frac{T}{2\pi} &= \sqrt{\frac{l}{32.2}} \\ \left(\frac{T}{2\pi}\right)^2 &= \sqrt{\frac{l}{32.2}}^2 \\ \frac{T^2}{4\pi^2} &= \frac{l}{32.2} \\ 32.2 \cdot \frac{T^2}{4\pi^2} &= 32.2 \cdot \frac{l}{32.2} \\ \frac{32.2T^2}{4\pi^2} &= l\end{aligned}$$

Thus, the length l as a function of the period T is given by

$$l(T) = \frac{32.2T^2}{4\pi^2}$$

- (b) How long is a pendulum whose period is 3 seconds?

We are given the period and want to find the length. Substituting into our result from part (a),

$$\begin{aligned}l(3) &= \frac{32.2 \cdot 3^2}{4\pi^2} \\ &\approx 7.34\end{aligned}$$

Thus the pendulum should be 7.34 feet long.

¹Sullivan, *Precalculus: Enhanced with Graphing Utilities*, p. 271, #96.