

## Normal modes on a string

Philippe W. Courteille, 05/02/2021

**Solution:** a. The work is,

$$\begin{aligned} W &= \int_0^h F dh' = 2 \int_0^h T \sin \alpha dh' = 2T \int_0^h \frac{h' dh'}{\sqrt{h'^2 + (L/2)^2}} = LT \int_0^{2h/L} \frac{z dz}{\sqrt{z^2 + 1}} \\ &= LT \left( \sqrt{1 + \left(\frac{2h}{L}\right)^2} - 1 \right) \simeq \frac{2h^2 T}{L} . \end{aligned}$$

b. Periodicity is given by the fundamental vibration.