Given and Required:

Determine the energy necessary to stretch a spring (with a spring constant of 200 lbf/in) 4 inches. Express your answer in Btu.

$$1 \cdot Btu = 778.169 \; \text{ft lbf}$$

Solution:

The spring constant is defined as

$$k := 200 \; \frac{\text{lbf}}{\text{in}}$$

The length for the spring to be stretch is defined as

$$L := 4 \; \text{in}$$

The energy necessary to stretch the spring will be determined by the work required to stretch the spring. The work necessary to stretch a spring is given by

$$W = \int_{1}^{2} F \, dx$$

where F is the force applied to the spring and dx is the distance that the force is applied. The force necessary to stretch the spring is given by Hooke's Law or simple

$$W = \int_{1}^{2} kx \, dx$$

The limits of the integral will be from 0 to L (or $4 \; \text{in}$). This is shown below.

$$W := \int_{0}^{L} k \cdot x \, dx = 1600 \; \text{in lbf}$$

Knowing the conversion between Btu and in lbf, the energy required in BTU may be found by a simple unit conversion. However, since this solution is beening done in Smath Solver, Smath Solver can do it for us.

$$\boxed{W = 0.1713 \; BTU}$$