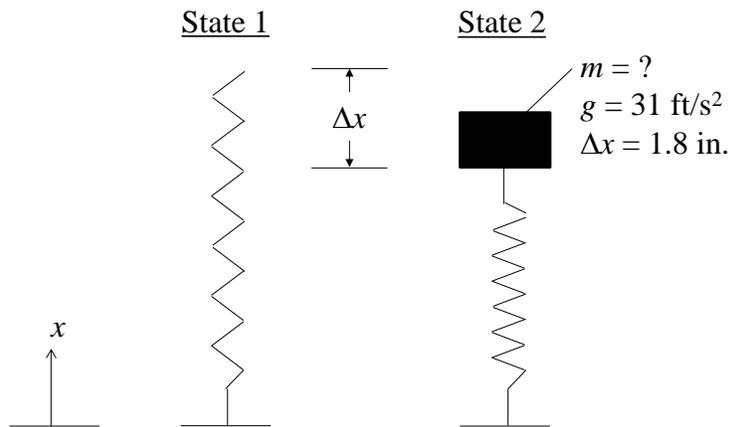


**1.11** A spring compresses in length by 0.14 in. for every 1 lbf of applied force. Determine the mass of an object, in pounds mass, that causes a spring deflection of 1.8 in. The local acceleration of gravity = 31 ft/s<sup>2</sup>.

**KNOWN:** A spring is compressed by an object of unknown mass. The local acceleration of gravity is known.

**FIND:** Determine the object's mass.

**SCHEMATIC AND GIVEN DATA:**



**ENGINEERING MODEL:**

1. Local gravitational acceleration is constant at 31 ft/s<sup>2</sup>.

**ANALYSIS:** The spring is known to deflect 0.14 inch for every 1 lbf of applied force. Thus, we begin by determining the weight of the object ( $F_{\text{grav}}$ ) using the deflection ( $\Delta x$ ) given as 1.8 inches.

$$\Delta x = 1.8 \text{ in.} = \left( 0.14 \frac{\text{in.}}{1 \text{ lbf}} \right) (F_{\text{grav}})$$

$$(F_{\text{grav}}) = \frac{1.8 \text{ in.}}{\left( 0.14 \frac{\text{in.}}{1 \text{ lbf}} \right)} = 12.86 \text{ lbf}$$

The mass can be determined by using the equation,  $F_{\text{grav}} = mg$ .

$$m = \frac{F_{\text{grav}}}{g} = \frac{12.86 \text{ lbf}}{31 \frac{\text{ft}}{\text{s}^2}} \left| \frac{32.2 \frac{\text{lb} \cdot \text{ft}}{\text{s}^2}}{1 \text{ lbf}} \right| = \text{rounded } \underline{\underline{13.36 \text{ lb}}}$$