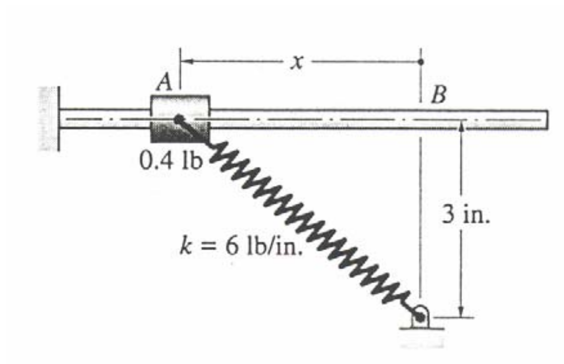
http://www.Drshokuhi.com

سایت آموزش مهندسی مکانیک ایران

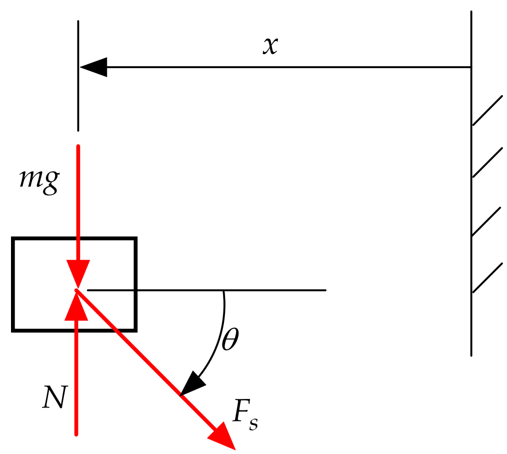
## Example 7.2

The free length of the spring that is attached to the 0.4-lb slider $A$ is 0.5 in. If the slider is released from rest when $x$ = 8 in., calculate its initial acceleration. Neglect friction.




**Solution:**

The free-body diagram of the slider at any position $x$ is shown below.



Since the only nonzero acceleration is in the horizontal direction we can write:

$$m\ddot{x} = -F_s \cos\theta$$

The right-hand side has a negative sign because $x$ is positive to the left and the tensile force in the spring is to the right. The spring force is given by

$$F_s = k(l - l_0) = k\left(\sqrt{x^2+9} - 0.5\right)$$

The direction of the force is given by

$$\cos\theta = \frac{x}{l} = \frac{x}{\sqrt{x^2+9}}$$

Thus the acceleration of the slider is given by

$$\ddot{x} = -\frac{k}{m}\left(\sqrt{x^2+9} - 0.5\right)\frac{x}{\sqrt{x^2+9}} = \frac{k}{m}\left(\frac{0.5x}{\sqrt{x^2+9}} - x\right)$$

Substituting the given numerical values for the specified position we obtain

$$\ddot{x} = \frac{6}{(0.4)/(386.4)}\left(\frac{0.5(8)}{\sqrt{8^2+9}} - 8\right) = -43,650 \text{ in/s}^2 = -3638 \text{ ft/s}^2$$

The negative sign indicates that the acceleration of the slider is to the right at the specified position.