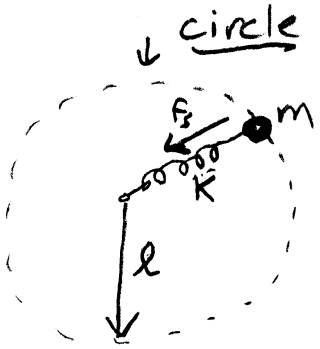
6-85



$m = 2.1\,kg$
$K = 150\,N/m$
$\ell_0 = .18\,m$
$v = 1.4\,m/s$
$\ell = ?$

Neglect friction

- only horizontal force acting on mass is the spring force, f_s, which acts in the direction of centripetal acceleration, v^2/ℓ

$$f_s = K(\ell - \ell_0) = ma_r$$ (still Mr. Newton $\Sigma F_r = ma_r$, $f_s = \frac{mv^2}{\ell}$)

$$K(\ell - \ell_0) = \frac{mv^2}{\ell}$$

$$\ell^2 - \ell_0\ell = \frac{mv^2}{K}$$

$$\ell^2 - \ell_0\ell - \frac{mv^2}{K} = 0$$ quadratic eqn in ℓ

$$\ell = -b \pm \sqrt{b^2 - 4ac} \over 2a$$

$$\ell = \frac{\ell_0 \pm \sqrt{\ell_0^2 + 4mv^2/K}}{2}$$

- Do we want positive or negative root?
  Think about what would actually happen... The spring will stretch out so the total length should be greater than ℓ_0 and most certainly greater than $\ell_0/2$

$$\ell_+ = \frac{.18m + \sqrt{(.18m)^2 + 4(2.1kg)(1.4m/s)^2/(150N/m)}}{2}$$

$$\ell_+ = .279m$$

$$\boxed{\ell = 27.9\,cm}$$