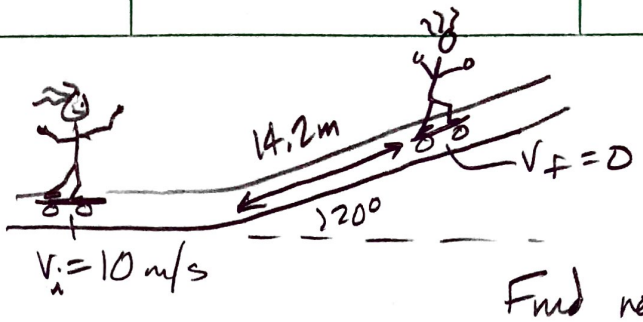
8.40



Find net frictional force going up the ramp?

$$\Sigma E_i = \Sigma E_f$$

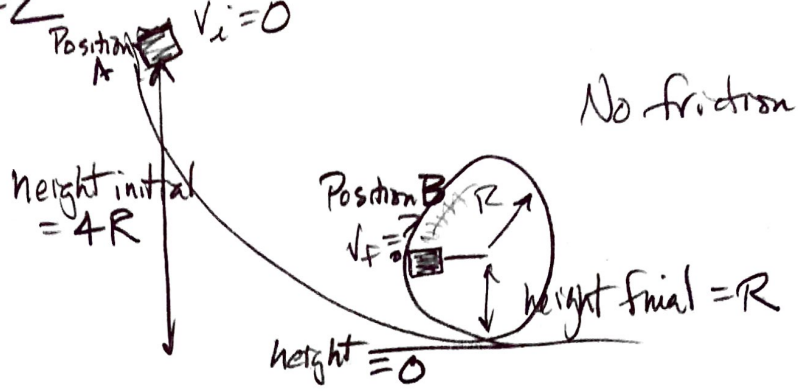
$$K_i + U_i = K_f + U_f + \Delta E_{int}$$

$$\frac{1}{2}mv_i^2 + 0 = 0 + mgh_f + F_f x$$

$$\frac{1}{2}(40)(10)^2 = (40)(9.8)(14.2\sin 20) + F_f(14.2)$$

$$F_f = \boxed{6.77\,N}$$

8.42



a) $U + K = U + K$

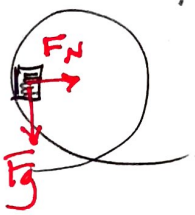
$mgh + \cancel{0} = mgh + \frac{1}{2}mV_f^2$

$4Rg = Rg + \frac{1}{2}V_f^2$

$V_f = \boxed{\sqrt{6Rg}}$

b) Force of track on block at point B?

$\Sigma F_c = \frac{mv^2}{r}$

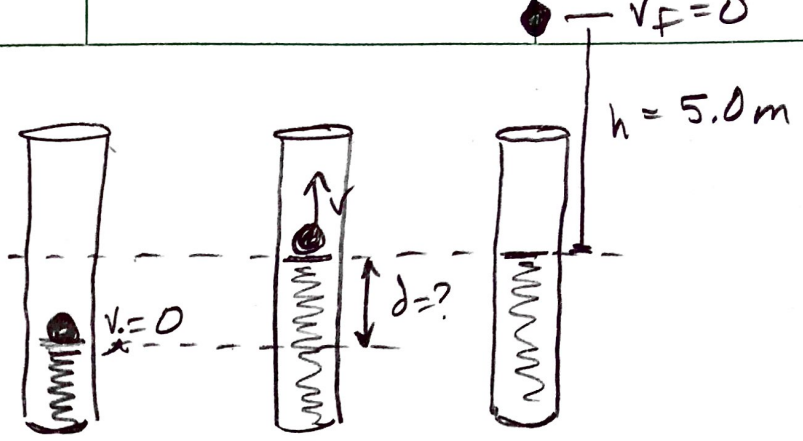


$F_N = \frac{mv^2}{r}$

$= \frac{m(\sqrt{6Rg})^2}{R}$

$= \boxed{6mg}$

8.43



$k_{spring} = 12\,N/cm \times \frac{100\,cm}{m} = 1200\,N/m$

$m = 15g = 0.015\,kg$

Original compression $d = ?$

$$\Sigma E_i = \Sigma E_f$$

$$U_s + U_g + K = U_s + U_g + K$$

$$\frac{1}{2}kx^2 + 0 + 0 = 0 + mgh + 0$$

$$\frac{1}{2}kd^2 = mg(h+d)$$

$$\frac{1}{2}kd^2 - mgd - mgh = 0$$

$$600d^2 - 0.147d - 0.735 = 0$$

Quadratic equation.

$$x = 0.035 = \boxed{3.5\,cm}$$