Problem 8.5
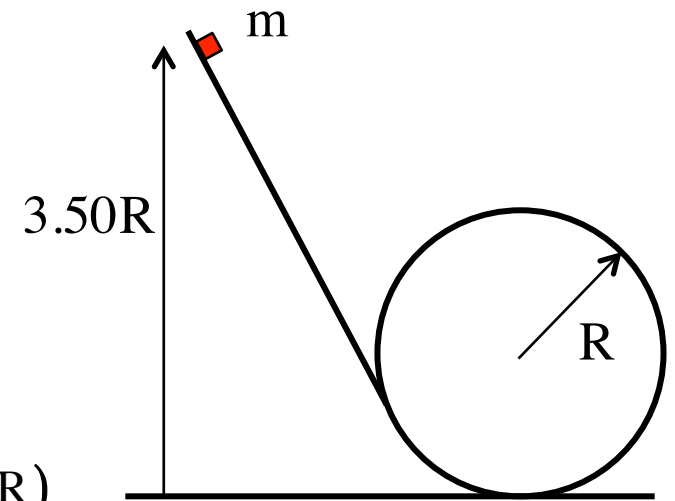
a.) Starting from rest, and assuming the system is frictionless, the speed at the top of the loop will be:

$$\sum KE_1 + \sum U_1 + \sum W_{ext} = \sum KE_2 + \sum U_2$$

$$0 + mg(3.5R) + 0 = \frac{1}{2}m(v_{top})^2 + mg(2R)$$

$$\Rightarrow \quad v_{top} = [3gR]^{1/2}$$

b.) The normal at the top will be:

$$\sum F_{centr}:$$

$$-N - mg = -ma_{centr}$$

$$= -m\left(\frac{(v_{top})^2}{R}\right) = -m\left(\frac{((3gR)^{\frac{1}{2}})^2}{R}\right)$$

$$\Rightarrow \quad -N = mg - m(3g) \quad \Rightarrow \quad N = 2mg$$