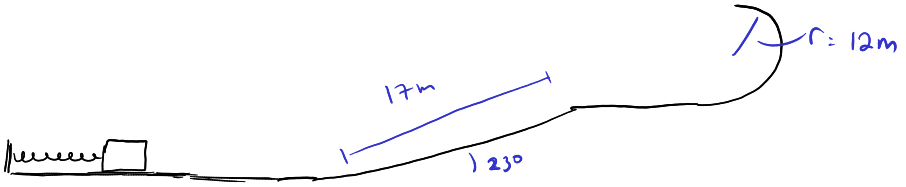
A block of mass 7.00 kg is pushed against a horizontal elastic spring with a spring constant of k=50.0 N/m. The block is then released from rest, and moves up a 23.0 degree incline that is 17.0m long. It then travels along another horizontal surface before entering a loop of radius 12m. All surfaces are frictionless. Find the minimum spring compression needed in order for the block to not loose contact with the loop when its at the top of the loop



@ top of loop:

$m\frac{v^2}{r} = mg$

$v = \sqrt{rg}$

$$\frac{1}{2}k\Delta x^2 = mgH + \frac{1}{2}mrg = mg\left[L\sin\theta + 2r\right] + \frac{1}{2}mrg$$

$$\frac{1}{2}k\Delta x^2 = mg\left[L\sin\theta + 2r + \frac{1}{2}r\right] = mg\left[L\sin\theta + \frac{5}{2}r\right]$$

$$k\Delta x^2 = 2mg\left[L\sin\theta + \frac{5}{2}r\right]$$

$$\Delta x = \sqrt{\frac{2mg}{k}\left[L\sin\theta + \frac{5}{2}r\right]} = \sqrt{\frac{2(7.00\,kg)(9.81\,m/s^2)}{50\,N/m}\left[17m\sin(23°) + \frac{5}{2}(12m)\right]}$$

$$= \boxed{10.03\,m}$$