SHOW ALL WORK!!!!
REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

A block of mass \( m \) is given an initial velocity by the spring. The spring has a spring constant \( k \), and is squeezed 0.200 m when the block is at A. Between A and B the slope has friction coefficients \( \mu_s = 0.75 \) and \( \mu_k = 0.65 \). After point B the system is frictionless. The block goes around the circular loop of radius \( R \) and is in contact with the loop all the way. The distance between A and B is 2.40 m. Assume the size of the block is small compared to \( R \). The vertical position of B is the same as the center of the loop.

\( m = 0.175 \text{ kg}; k = 120.0 \text{ N/m}; R = 0.500 \text{ m}; \theta = 27.0^\circ \)

(a) Calculate the speed of the block at the exact top of the loop.
(b) Find the normal force of the loop on the block at the exact top.
(c) Determine the normal force on the block at C, directly opposite the center of the loop.

\[
\frac{AB}{\theta} = mg \sin \theta + \frac{kx^2}{2} + mgR = F_{fr} \frac{L}{2} + \frac{mu_t^2}{2} + 2mgR
\]

\[
F_{fr} = mg \mu_s \cos \theta
\]

\[
\frac{mu_t^2}{2} = \frac{kx^2}{2} + mgL \left( \sin \theta - \mu_k \cos \theta \right) - mgR
\]

\[
a) \quad v = \sqrt{\frac{kx^2}{m} + 2gL \left( \sin \theta - \mu_k \cos \theta \right) - 2gR} = 3.42 \text{ m/s}
\]

\[
b) \quad N = \frac{mu_t^2}{R} - mg = 2.39 \text{ N}
\]

\[
c) \quad N = \frac{v^2}{R} - mg = 7.54 \text{ N}
\]
c) \[ v_c = \sqrt{\frac{k}{m}} x^2 + 2g \angle (\sin \theta - \mu \cos \theta) = 4.64 \text{ m/s} \]

\[ N_c = -\frac{mv_c^2}{R} = \boxed{7.54 \text{ N}} \]

Sign is not important