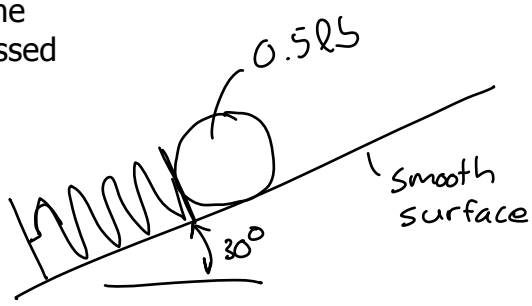
Kinetics of a Particle: Conservation of Energy

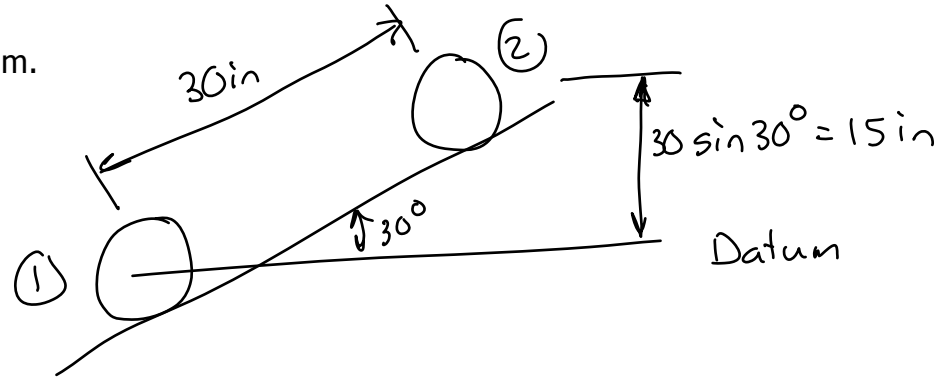
Problem Statement: If the spring is initially compressed 2 inches, determine the smallest stiffness, k, to shoot the ball a max distance of 30 inches if the spring is compressed an additional 3 inches and is released from rest.



1.) Draw the Free-Body Diagram if needed.

Conservative forces only

2.) Define the datum.



3.) Determine the kinetic and potential energy, and work.

$T_1 = 0$

$T_2 = 0$ (Ball momentarily stops at the max distance)

$V_{1g} = 0$ $\quad V_{1e} = \frac{1}{2} k (2in + 3in)^2 = 12.5\,k$

$V_{2g} = (0.5lb)(15in) = 7.5\ lb\cdot in$

$V_{2e} = \frac{1}{2} k (2in)^2 = 2\,k$

4.) Solve for the unknowns.

$T_1 + V_1 = T_2 + V_2$

$0 + 12.5k = 0 + 7.5 + 2k$

$\boxed{k = 0.714\ lb/in}$