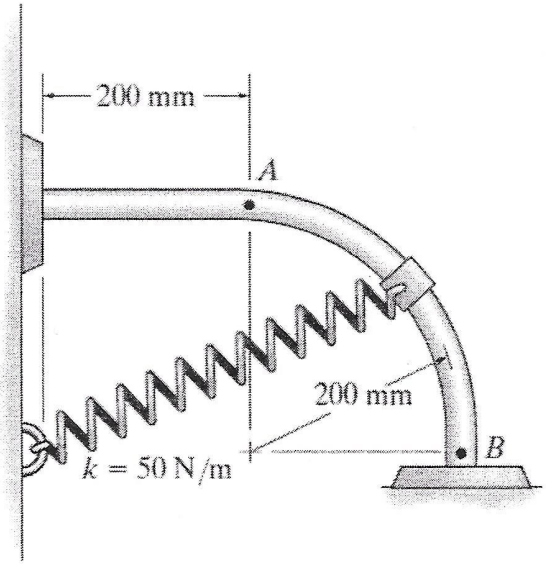
The 5-kg collar has a velocity of 5 m/s to the right when it is at A. It then travels along the smooth guide. Determine its speed when its center reaches point B and the normal force it exerts on the rod at this point. The spring has an unstretched length of 100 mm and B is located just before the end of the curved portion of the rod.



@ A:

$E_p = mg\Delta h = 5(9.81)(0.2) = 9.81\,J$

$E_k = \frac{1}{2}mv_A^2 = \frac{1}{2}(5)(5)^2 = 62.5\,J$

$x_A = \sqrt{(0.2)^2 + (0.2)^2} = 0.2828\,m$

$\Delta x_A = 0.2828 - 0.1 = 0.1828\,m$

$E_s = \frac{1}{2}k\Delta x_A^2 = \frac{1}{2}(50)(0.1828)^2 = 0.8358\,J$

@ B:

$E_p = 0$

$E_k = \frac{1}{2}mv_B^2$

$E_s = \frac{1}{2}k\Delta x_B^2 = \frac{1}{2}(50)(0.3)^2 = 2.25\,J$

$x_B = 0.2 + 0.2 = 0.4\,m$

$\Delta x_B = 0.4 - 0.1 = 0.3\,m$

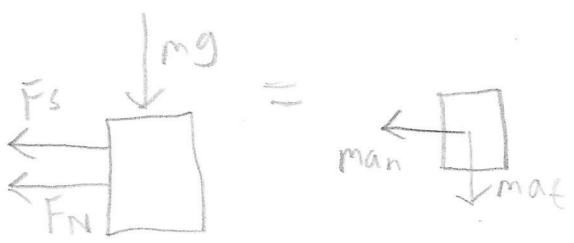
C.O.E.

$9.81 + 62.5 + 0.8358 = 0 + \frac{1}{2}(5)v_B^2 + 2.25$

$2.5v_B^2 = 70.8958$

$\boxed{v_B = 5.33\,\frac{m}{s}}$

FBD @ B



IRD

$\sum F_n = ma_n = F_s + F_N$

$\frac{mv_B^2}{r} = k\Delta x_B + F_N$

$F_N = \frac{mv_B^2}{r} - k\Delta x_B$

$= \frac{(5)(5.33)^2}{(0.2)} - (50)(0.3)$

$\boxed{F_N = 694.0\,N}$