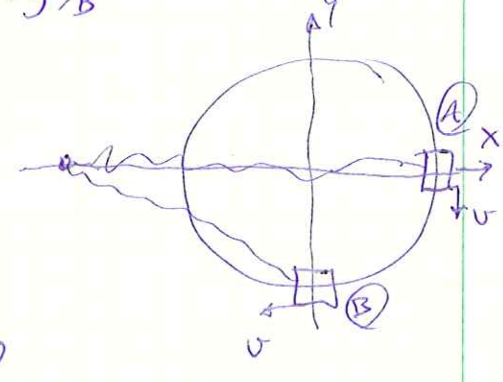
PROB. 13-73

$W = 1\ \text{LB}$, $l_u = \frac{5}{12}\ \text{ft}$, $K = 10\ \frac{\text{LB}}{\text{ft}}$, $v_A = 0$

FIND v_B AND N_B

$T_A + (V_e)_A + (V_g)_A = T_B + (V_e)_B + (V_g)_B$



AT POINT A: $v_A = 0$

$l_A = \frac{17}{12}\ \text{ft}$, $\Delta X_A = \underbrace{\frac{17}{12} - \frac{5}{12}}_{l_A - l_u} = 1\ \text{ft}$

$h_A = 0$

$T_A = 0$, $(V_e)_A = \frac{1}{2} K (\Delta X_A)^2$, $(V_g)_A = 0$

AT POINT B:

$l_B = \sqrt{1 + \left(\frac{5}{12}\right)^2} = \sqrt{\frac{144 + 25}{144}} = \frac{13}{12}\ \text{ft}$

$\Delta X_B = l_B - l_u = \frac{13}{12} - \frac{5}{12} = \frac{8}{12} = \frac{2}{3}\ \text{ft}$

$h_B = -\frac{5}{12}\ \text{ft}$

$T_B = \frac{1}{2} m v_B^2 = \frac{1}{2} \frac{W}{g} \cdot v_B^2$, $(V_e)_B = \frac{1}{2} K (\Delta X_B)^2$,

$(V_g)_B = W h_B$

$0 + \frac{1}{2} K (\Delta X_A)^2 + 0 = \frac{1}{2} \frac{W}{g} v_B^2 + \frac{1}{2} K (\Delta X_B)^2 + W h_B$

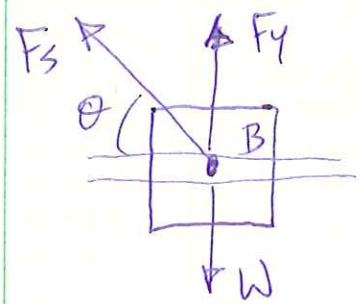
$v_B = \sqrt{\frac{2g}{W} \left\{ \frac{1}{2} K \left[(\Delta X_A)^2 - (\Delta X_B)^2 \right] - W h_B \right\}}$

$$v_B = \sqrt{\frac{2\left(32.2\ \frac{\text{ft}}{\text{s}^2}\right)}{(1\ \text{LB})} \cdot \left\{ \frac{\left(10\ \frac{\text{LB}}{\text{ft}}\right)}{2} \cdot \left[(1\ \text{ft})^2 - \left(\frac{2}{3}\ \text{ft}\right)^2 \right] - (1\ \text{LB})\left(-\frac{5}{12}\ \text{ft}\right) \right\}}$$

$$\boxed{v_B = 14.34\ \frac{\text{ft}}{\text{s}}}$$

PROB. 13-73 CONT.

FBD AT POINT B:



$$\theta = \tan^{-1}\left(\frac{5}{12}\right) = 22.62^\circ$$

$$\Sigma F_n = m\frac{v_n^2}{g} = \frac{W}{g}\cdot\frac{v_B^2}{r}$$

$$F_Y + F_S\cdot\sin\theta - W = \frac{W}{g}\cdot\frac{v_B^2}{r}$$

$$F_S = k\Delta x_B$$

$$F_Y = W\left(1 + \frac{1}{g}\cdot\frac{v_B^2}{r}\right) - k\Delta x_B\cdot\sin\theta$$

$$F_Y = (1\text{ LB})\left[1 + \frac{1}{\left(32.2\frac{ft}{s^2}\right)}\cdot\frac{\left(14.34\frac{ft}{s}\right)^2}{\left(\frac{5}{12}ft\right)}\right] - \left(10\frac{LB}{ft}\right)\left(\frac{2}{3}ft\right)\cdot\sin 22.62^\circ$$

$$\boxed{F_Y = 13.76\text{ LB}}$$