PROB. 13-68

$m = 50 \, kg$, $K = 30 \, \frac{KN}{m} = 3 \times 10^4 \, \frac{N}{m}$, $\Delta X_1 = 50^{mm} = 0.05^m$

$U_1 = 2 \, \frac{m}{s}$ @ 8^m, FIND ADDITIONAL DEFORMATION
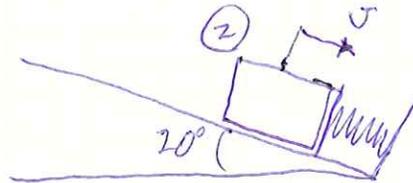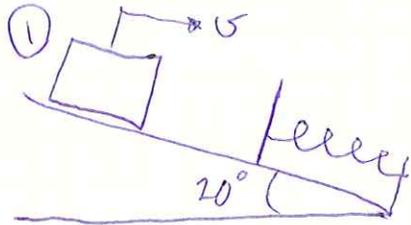
$T_1 + (Ve)_1 + (Vg)_1 = T_2 + (Ve)_2 + (Vg)_2$

POINT 1: $U_1 = 2 \, \frac{m}{s}$, $h_1 = 8 \cdot \sin 20° = 2.736^m$,

$(\Delta X_1) = 0.05^m$

$T_1 = \frac{1}{2} m U_1^2$, $(Ve)_1 = \frac{1}{2} K (\Delta X_1)^2$, $(Vg)_1 = m g h_1$

POINT 2: $U_2 = 0$, $\Delta X_2 = \cancel{0.05m} \, \Delta X_1 + \Delta X$

$h_2 = -\Delta X \cdot \sin 20°$

$T_2 = 0$, $(Ve)_2 = \frac{1}{2} K (\Delta X_1 + \Delta X)^2$, $(Vg)_2 = -\Delta X \cdot \sin 20°$

$\frac{1}{2} m U_1^2 + \frac{1}{2} K (\Delta X_1)^2 + m g h_1 = 0 + \frac{1}{2} K (\Delta X_1 + \Delta X)^2 - m g \Delta X \sin 20°$

$\frac{1}{2} (50^{kg})(2 \, \frac{m}{s})^2 + \frac{1}{2} (3 \times 10^4 \, \frac{N}{m})(0.05^m)^2 + (50^{kg})(9.81 \, \frac{m}{s^2})(2.736^m)$

$= \frac{1}{2} (3 \times 10^4 \, \frac{N}{m})(0.05 + \Delta X)^2 - (50^{kg})(9.81 \, \frac{m}{s^2}) \cdot \sin 20° \cdot \Delta X$

$1480 = 1.5 \times 10^4 (0.05 + \Delta X)^2 - 167.7 \Delta X$

$1480 = 37.5 + 1500 \Delta X + 1.5 \times 10^4 (\Delta X)^2 - 167.7 \Delta X$

$1.5 \times 10^4 (\Delta X)^2 + 1332 \Delta X - 1442 = 0$

PROB. 13-68 CONT.

$$\Delta x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\Delta x = \frac{-1332 \pm \sqrt{1332^2 - 4(1.5 \times 10^4)(-1442)}}{2(1.5 \times 10^4)}$$

$$\Delta x = -0.0444 \pm 0.3132$$

$$\boxed{\Delta x = 0.2688^m}$$