

Problem 10.54 (cont)

3-16-21

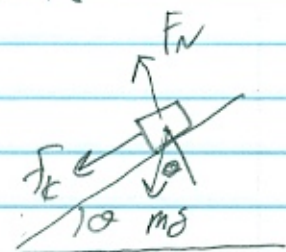
$$E_3 = \frac{1}{2} m V_3^2 + mg y_3$$

$$V_2 = 0$$

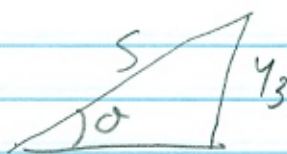
$$W_{NC} = F_k \cos \phi s = -F_k s$$

$$= -\mu_k F_N s$$

$$= -\mu_k mg \cos \theta s$$



$$\Sigma F_y = F_N - mg \cos \theta = 0$$



$$y_3 = s \sin \theta$$

$$\Rightarrow E_3 = E_0 + W_{NC}$$

$$mg y_3 = mg y_0 + \frac{1}{2} k x_0^2 - \mu_k mg \cos \theta s$$

solve for s (divide by mg)

$$s(\sin \theta + \mu_k \cos \theta) = y_0 + \frac{k x_0^2}{2mg}$$

$$s = \left[y_0 + \frac{k x_0^2}{2mg} \right] / [\sin \theta + \mu_k \cos \theta]$$

$$= \left[10 + \frac{(80,000)(.5)^2}{100(9.8)} \right] / [\sin 30^\circ + 0.15 \cos 30^\circ]$$

$$= 30.48 / 0.6299 = \boxed{48.4 \text{ m}}$$