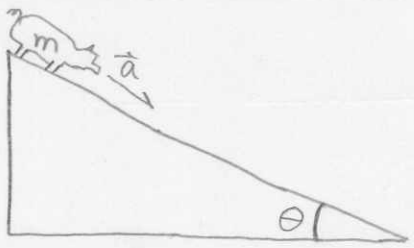
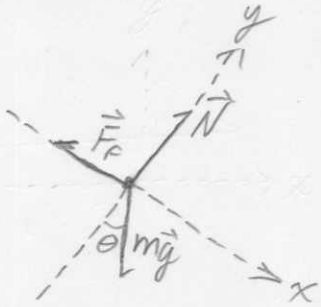
Force Homework, #3



$\theta = 35°$

$t_f = 2t_{NF}$



In general (Newton's 2nd law)

$F_x = mg\sin\theta - F_f = ma$

$mg\sin\theta - \mu_s N = ma$

$F_y = N - mg\cos\theta = 0$

$N = mg\cos\theta$

$mg\sin\theta - \mu_s mg\cos\theta = ma$

$$\boxed{a = g(\sin\theta - \mu_s\cos\theta)}$$

Kinematics

$x(t) = x_0^{\,0} + v_0^{\,0}t + \frac{1}{2}at^2$

$d = \frac{1}{2}at^2 \Rightarrow \boxed{d = \frac{1}{2}g(\sin\theta - \mu_s\cos\theta)t^2}$

Frictionless

$\mu_s = 0$

$d = \frac{1}{2}g\sin\theta\, t_{NF}^2$

Friction

$d = \frac{1}{2}g(\sin\theta - \mu_s\cos\theta)t_F^2$

$d = \frac{1}{2}g(\sin\theta - \mu_s\cos\theta)4t_{NF}^2$

divide

$$\frac{d}{d} = \frac{\frac{1}{2}g\sin\theta\, t_{NF}^2}{\frac{1}{2}g(\sin\theta - \mu_s\cos\theta)4t_{NF}^2} \Rightarrow \boxed{\mu_s = \frac{3}{4}\tan\theta}$$

$\mu_s = 0.53$