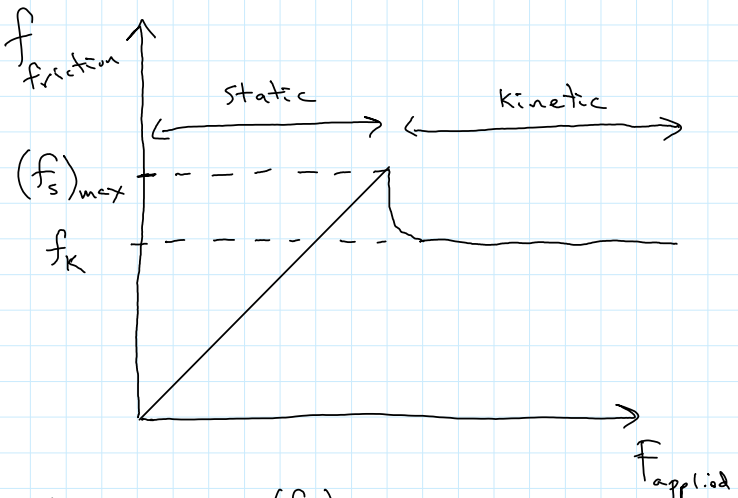
Phy 4A 10/14

Friday, October 14, 2016 9:58 AM

Goals for the Lecture:

1) Use Newton's Second Law to solve motion problems, including: multiple objects, incline planes, friction, pulleys, and ropes

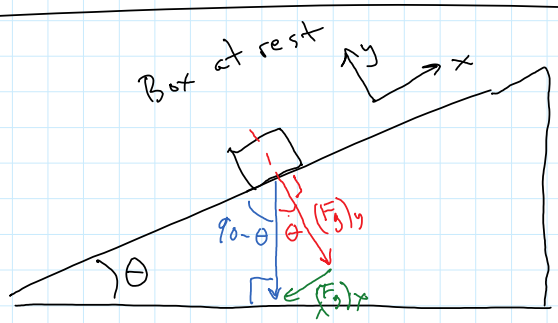
Friction



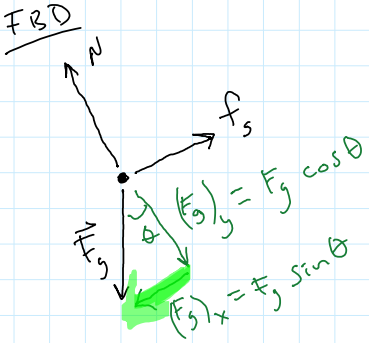
Static: $f_s \leq \mu_s N$ or $(f_s)_{max} = \mu_s N$

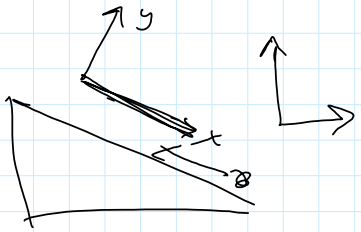
Kinetic: $f_k = \mu_k N$

Incline:



FBD



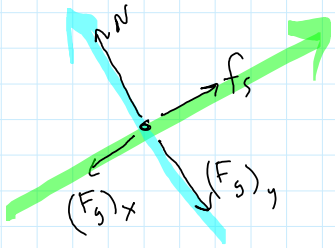


$\Sigma \vec{F} = m\vec{a}$

↑ +y

$\Sigma F_x = ma_x$ (+x →) $\Sigma F_y = ma_y$ (+y ↑)

FBD



$f_s - (F_g)_x = 0$

$f_s = (F_g)_x$

$= F_g \sin\theta$

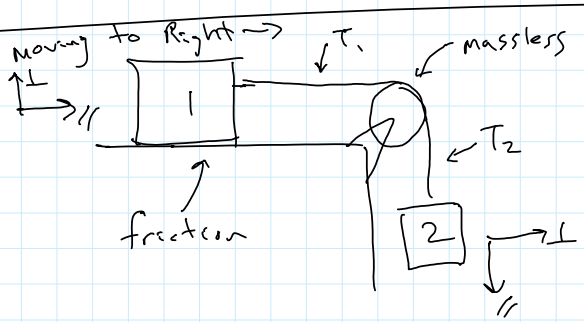
$= mg \sin\theta$

$N - (F_g)_y = 0$

$N = (F_g)_y$

$= mg \cos\theta$

Pulley:

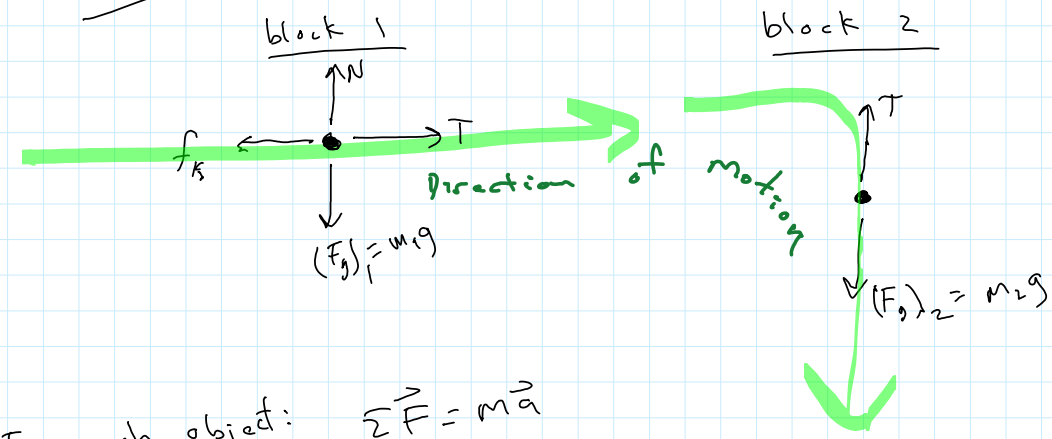


massless pulley means $T_1 = T_2 = T$

given: μ_k, m_1, m_2

find: a

FBD



For each object: $\Sigma \vec{F} = m\vec{a}$

block 1

$\Sigma \vec{F}_1 = m_1 \vec{a}_1$

$\Sigma \vec{F}_1 = m_1 \vec{a}$

$a_1 = a_2 = a$

block 2

$\Sigma \vec{F}_2 = m_2 \vec{a}_2$

$\Sigma \vec{F}_2 = m_2 \vec{a}$

$\sum \vec{F}_1 = m_1 \vec{a}$

$\sum F_{1\parallel} = m_1 a \quad \rightarrow + \quad \sum F_{1\perp} = 0$

$T - f_k = m_1 a \qquad N - m_1 g = 0$

$N = m_1 g$

$T - \mu_k N = m_1 a$

$\boxed{T - \mu_1 m_1 g = m_1 a}$

$\sum \vec{F}_2 = m_2 \vec{a}$

$\sum F_{2\parallel} = m_2 a \quad \downarrow +$

$m_2 g - T = m_2 a$

$\boxed{m_2 g - T = m_2 a}$