Review

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

Example

$\vec{F}_1 = (-6\hat{i} - 4\hat{j})\,N$

$\vec{F}_2 = (-3\hat{i} + 7\hat{j})\,N$

$M = 2\,kg$

$\vec{v}_i = 0$

$\vec{x}_i = (-2m, 4m)$

Find (a) $\vec{v}$ at $t = 10s$

(b) $\vec{x}$ at $t = 10s$

step 1: find $\vec{F}_1 + \vec{F}_2$

step 2: $\vec{a} = \dfrac{\vec{F}_1 + \vec{F}_2}{M}$

step 3:

x-direction

x_i, v_i, a_x, t } known

solve for v_{xf}, x_f

y-direction

y_i, v_i, a_y, t } known

solve for v_{yf}, y_f

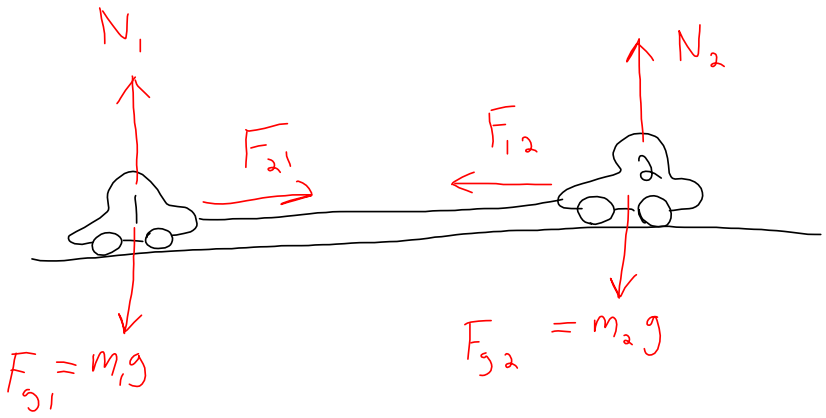
(see chapter 2)

Answers: $\vec{v}_f = (-45\hat{i} + 15\hat{j})\,\frac{m}{s}$

$\vec{x}_f = (-227\hat{i} + 79\hat{j})\,m$

Sec. 5.6 – Newton's 3rd Law

For every force, there is an equal and opposite force.

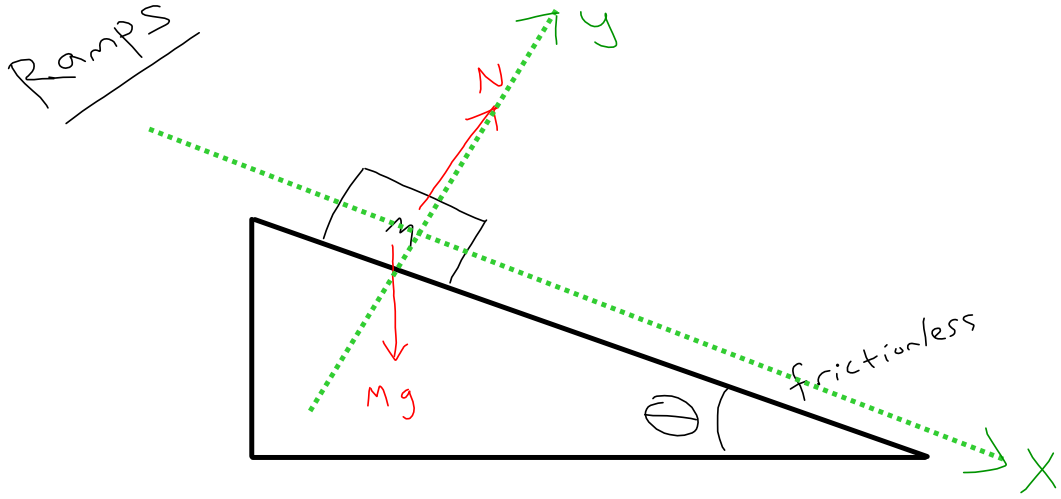


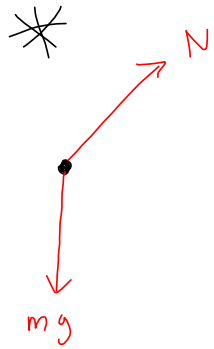
$\vec{F}_{21} = -\vec{F}_{12}$

$\vec{N}_1 = -\vec{F}_{g1}$

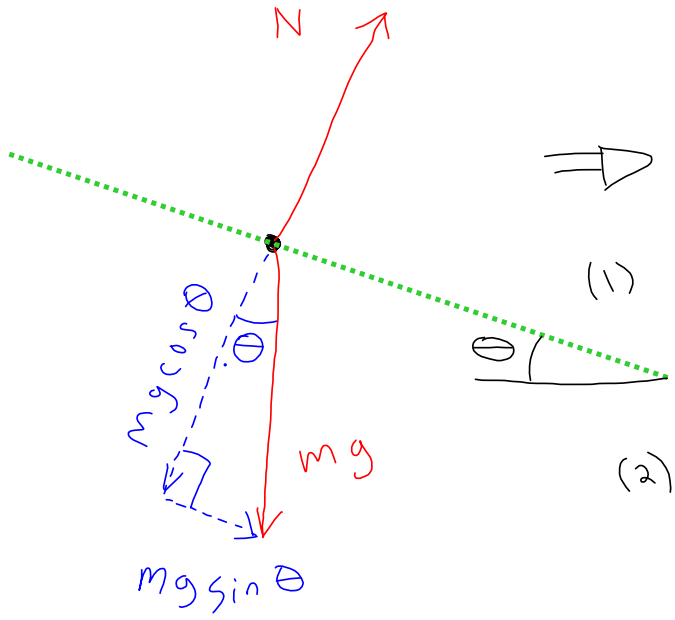
$\vec{N}_2 = -\vec{F}_{g2}$

The N's are <u>normal forces</u> and occur when surfaces push back on objects. They are <u>always perpendicular to the surface</u>.





Representing an object by a point and drawing all the forces acting on that point is called a <u>free-body diagram</u>.



⇒ conclusions:

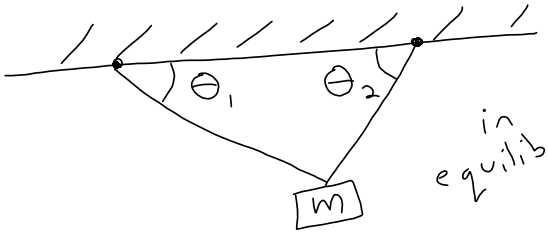
(1) $N = mg\cos\theta$

(2) $mg\sin\theta = ma_x$

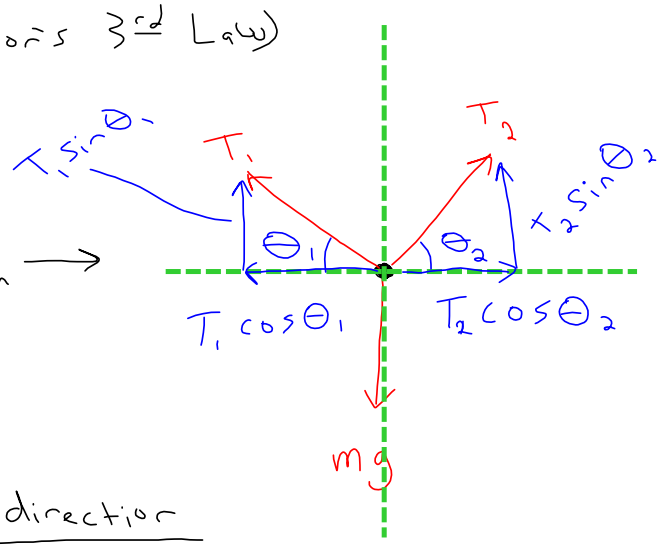
$a_x = g\sin\theta$

Cords - provide tension forces

- tension is same mag. (& opposite) on both ends of the cord (Newton's 3rd Law)



in equilibrium →



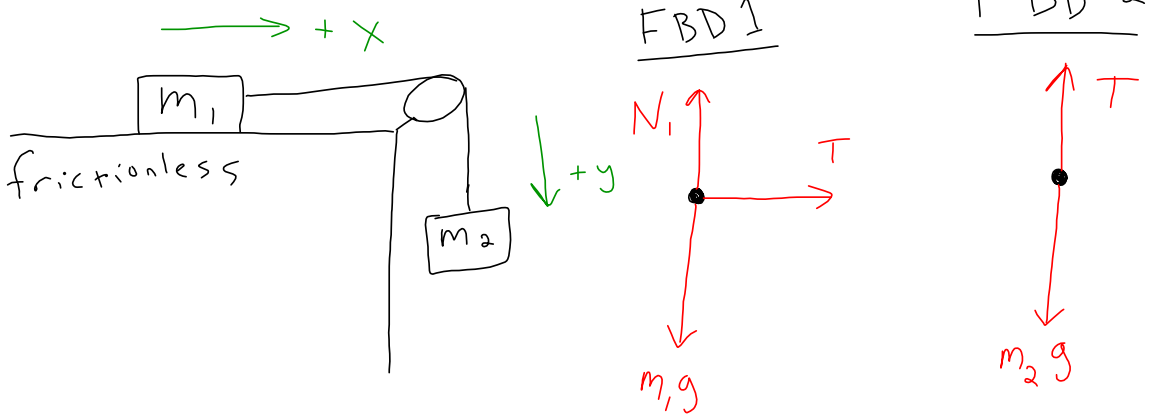
y-direction

$$T_1 \sin\theta_1 + T_2 \sin\theta_2 - mg = 0$$

x-direction

$$T_2 \cos\theta_2 - T_1 \cos\theta_1 = 0$$

(Ideal) pulleys – preserve tension, but change its direction.

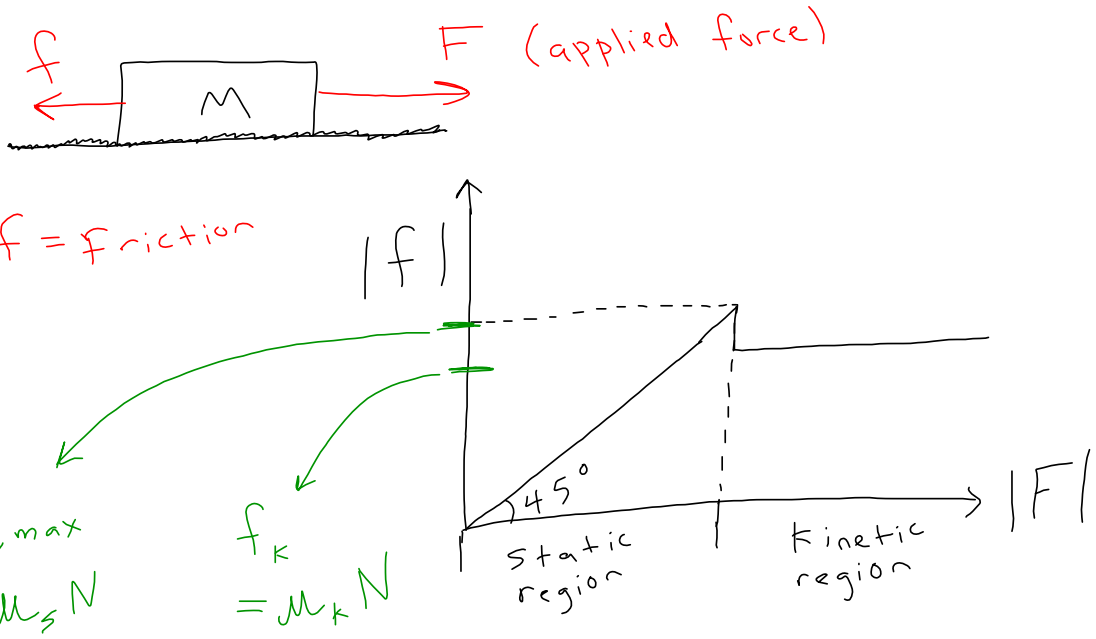


$N_1 = m_1 g$ $\quad m_2 g - T = m_2 a$

$T = m_1 a$

2 eq. 2 unknown

Friction



where N = normal force and

μ_s and μ_k = coefficients of static/kinetic friction

↳ property of the pair of materials in contact