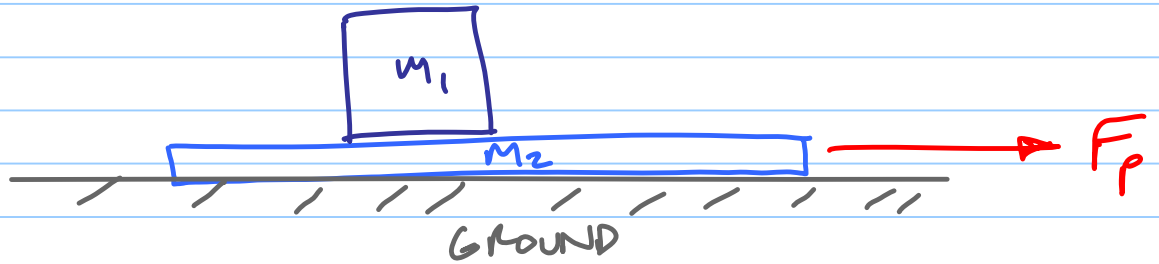
Note Title 2/27/2010

FRICTION PROBLEM



$\mu_{1,2} = \mu$

The coefficient of friction between block 1 and plate 2 is simply mu

$\mu_{2,GND} = 0$

The coefficient of friction between the plate and the ground is zero due to the "frictionless" claim.

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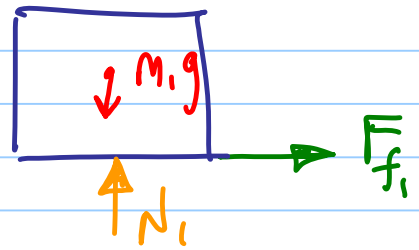
Draw the free body diagram (FBD) and set up the equations of motion for the block



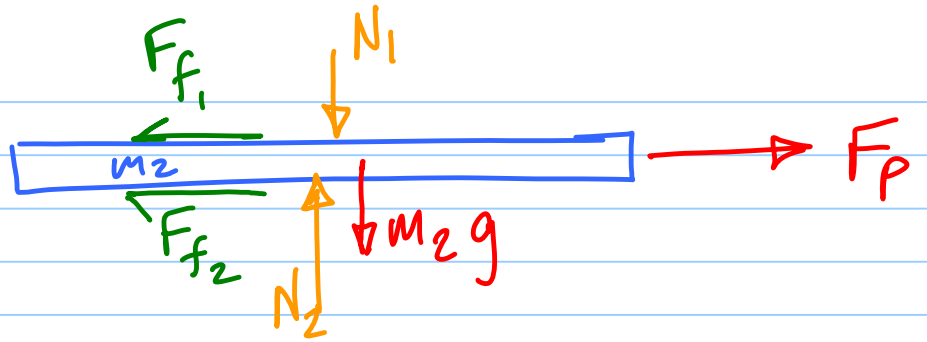
Remember that friction is always opposing another force. If there are no forces acting on a block to make it move, then there are no frictional forces.

Thus, eq. 1 won't actually accelerate due to F_f,1 but if that block accelerates, there will be a frictional force

$$\Sigma F_x = F_{f_1} = m_1 a_x \quad (1)$$

$$\Sigma F_y = N_1 - m_1 g = m_1 a_y \quad (a_y = 0 \text{ NOT MOVING IN } y\text{-DIR})$$

$$N_1 = m_1 g \quad (2)$$



$$\sum \vec{F}_x = m_2 \vec{a}_x = F_p - F_{f_1} - F_{f_2} = m_2 \cdot a_{2x}$$

$$F_p = m_2 \cdot a_{2,x} + F_{f_1} + F_{f_2}$$

$$F_{f_1} = \mu_{1,2,s} N_1$$

FRICTIONLESS

$$F_{f_2} = \mu_{2,G,s} N_2$$

$$F_{f,2} = 0$$

$$F_p = m_2 a_{2,x} + \mu_{1,2,s} \cdot N_1$$

$$N_1 = m_1 g$$

$$F_p = m_2 a_{2,x} + \mu_{1,2,s} \cdot m_1 g$$

$$F_{f_1} = m_1 a_{1,x}$$

Impulse:

$$I = \int F \cdot dt$$

$$\mu_{1,2,s} > \mu_{1,2,K}$$

$$F_p = m_2 a_{2x} + \mu_{12s} m_1 g \qquad \frac{dF_p}{da} = m_2$$

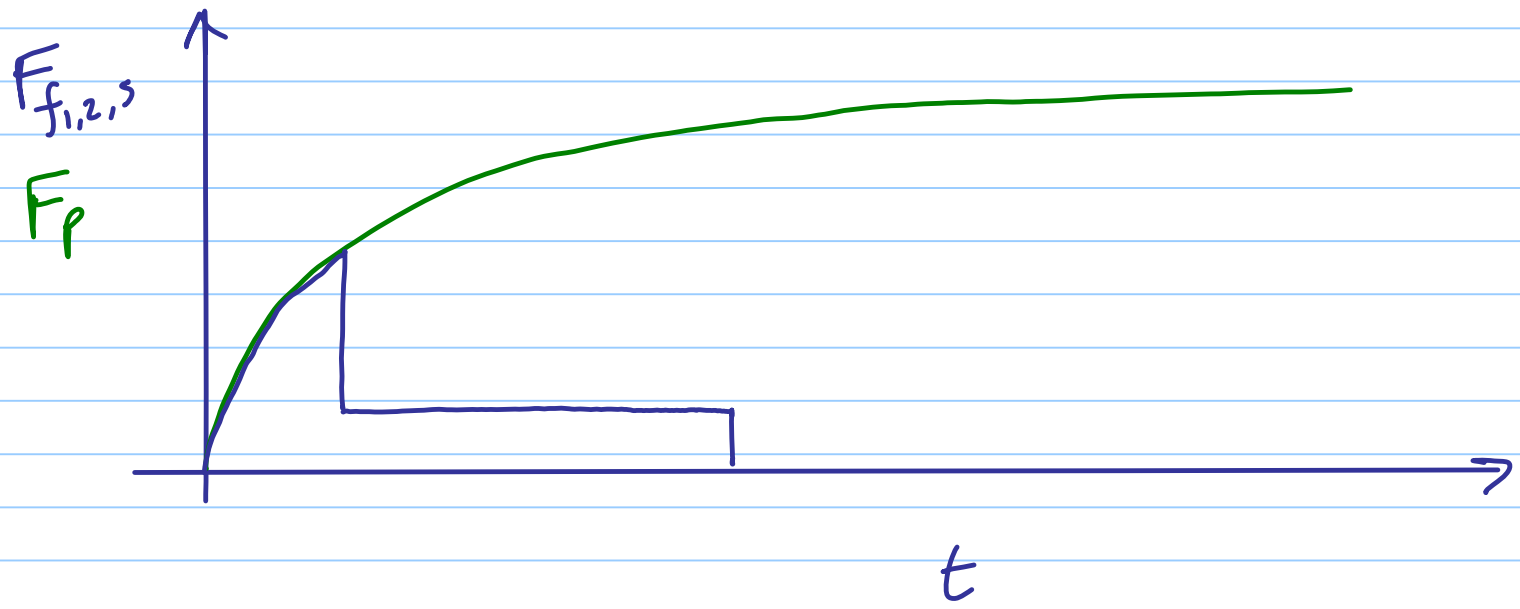
$$F_{f_1} = \mu_{1,2,s} m_1 g = m_1 a_{1x}$$

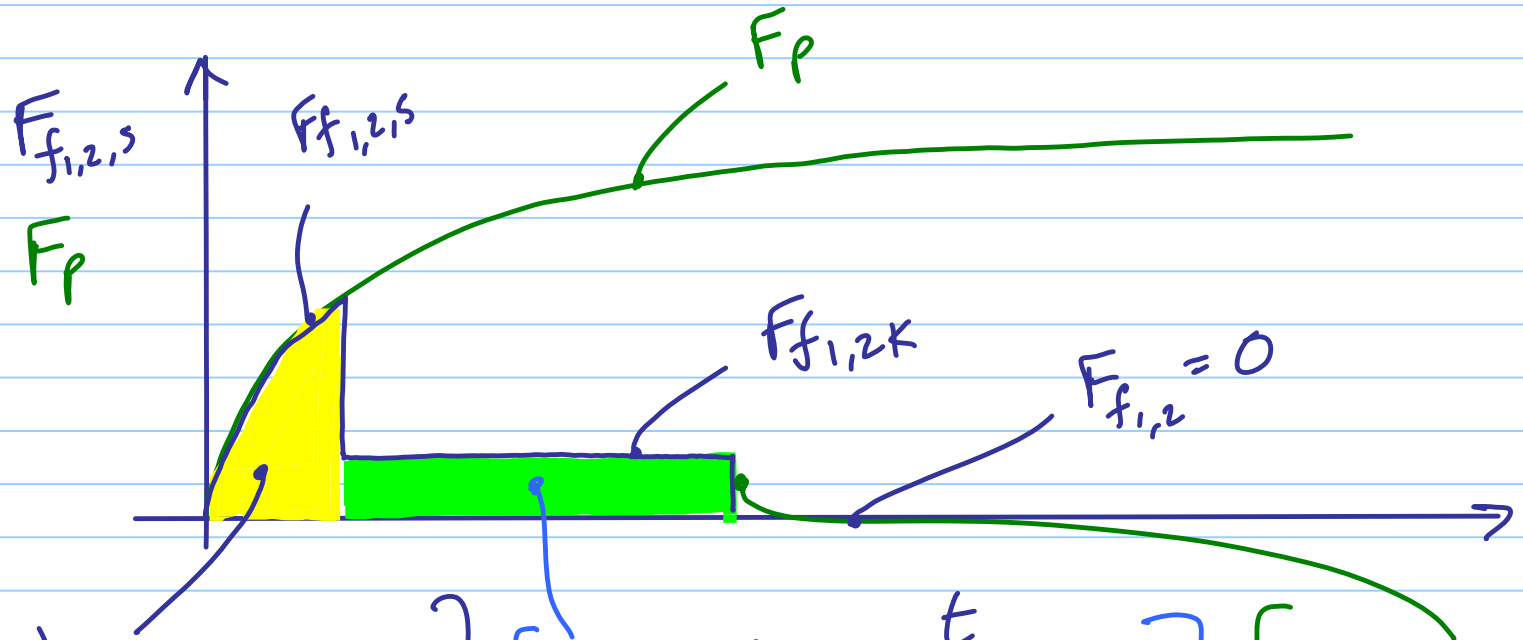
$a_{1x} = a_{2x}$ IN STATIC FRICTION

$$\mu_{1,2,s} \cdot g = a_{1x} = a_{2x}$$

$$F_p = m_2 (\mu_{1,2,s} \cdot g) + \mu_{1,2,s} \cdot m_1 \cdot g$$

$$F_{p,min} = \mu_{1,2,s} \cdot g \left(m_1 + m_2 \right)$$





BLOCK 1 (m_1) FEELS STATIC FRICTION. ACCELERATES W/PLATE 2 (m_2). $a_{x1} = a_{x2}$

BLOCK 1 (m_1) GOES INTO KINETIC OR SLIDING FRICTION. $F_{f_{1,2}}$ DROPS GOING FROM STATIC → KINETIC FRICTION

BLOCK m_1 FALLS OFF PLATE, m_2 & HAS NO MORE $F_{f_{1,2}}$