$$\left|\vec{F}_{GRAVITY}\right| = \underline{\underline{\left[9.8\right]}}\, M_{box}$$

"g"

$$\left|\text{Weight}\right| = \left|\vec{F}_{gravity}\right| \approx m_{box}\, g$$

NOT 2^{nd} LAW

1. 2^{nd} $\sum \vec{F} = m\vec{a}$

$\boxed{\hat{j}}$ $\sum F_y = m\cancel{a_y} \to 0$ No Motion in $\hat{j}$

$+N - F_g \cos(30) = 0$

$\therefore N = F_g \cos(30) = (5)(9.8)\cos(30)$ Answer

$\boxed{\hat{i}}$ $\sum F_x = m a_x$

$-F_g \sin(30) = 5 a_x$

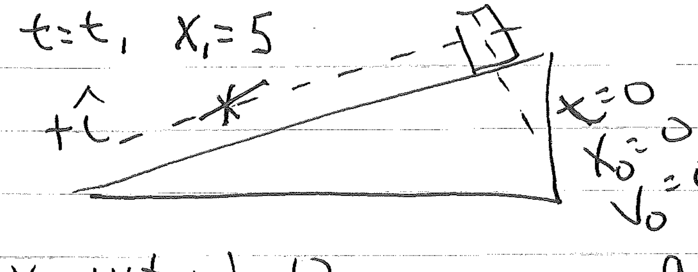
$-5(9.8)\sin(30) = 5 a_x$

$-4.9 \frac{m}{s^2} = a_x$ Answer

S.I.

?

How long would it take for box, starting from rest, to slide 5m down the ramp?



$$\left.\begin{array}{l} x(t) = x_0 + v_0 t + \frac{1}{2}at^2 \\ v(t) = v_0 + at \end{array}\right.$$

$$\Rightarrow \left[\begin{array}{l} x(t) = 2.45t^2 \quad \boxed{1} \\ v(t) = 4.9t \quad \boxed{2} \end{array}\right]$$

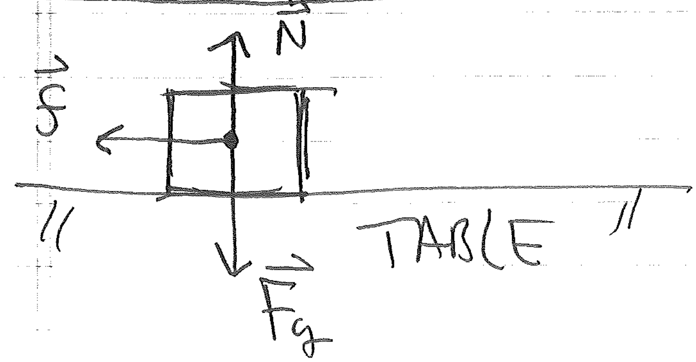
@ $t = t_1$, $x_1 = 5$, $v = v_1$

$\boxed{1} \Rightarrow 5 = 2.45t_1^2$

$\therefore t_1 = 1.43$ seconds **Answer**

$\boxed{2} \Rightarrow v_1 = 4.9t_1 = 7$ m/s

An Emperical Model for Friction ($\vec{f}$)

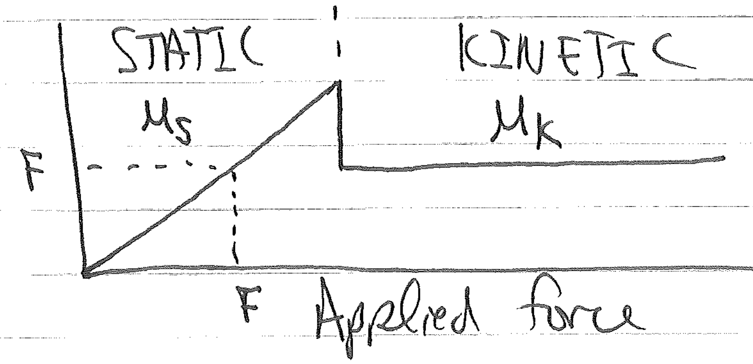


$|\vec{f}| \propto |\vec{N}|$

$|\vec{f}| = \mu |\vec{N}|$

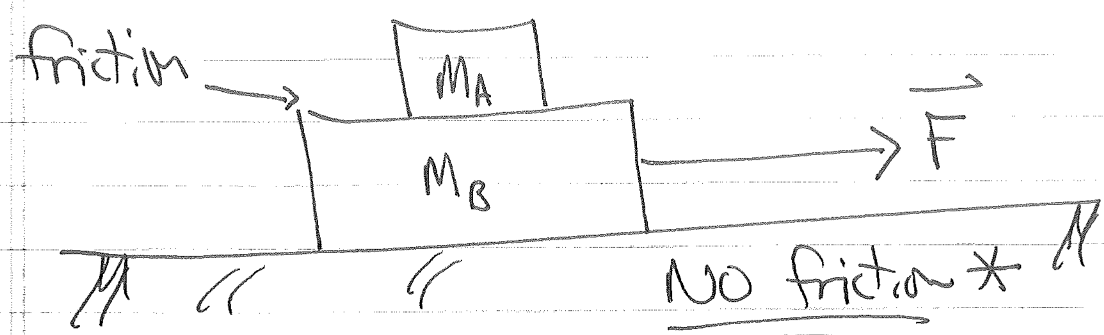
$\uparrow$ coefficient of friction

3 different coefficients!



Rolling friction (μ_R)

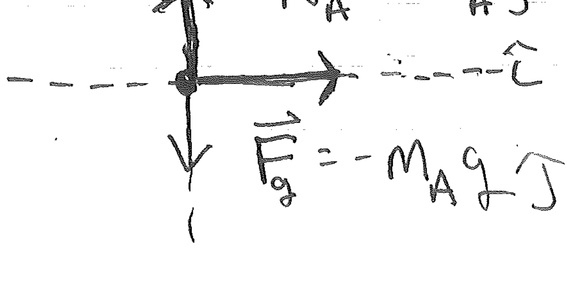
Related to HW 4.26



Boxes move together.

Assume boxes are accelerating* as move to right.

for MA



$\vec{f} = +\mu_s N_A \hat{i}$

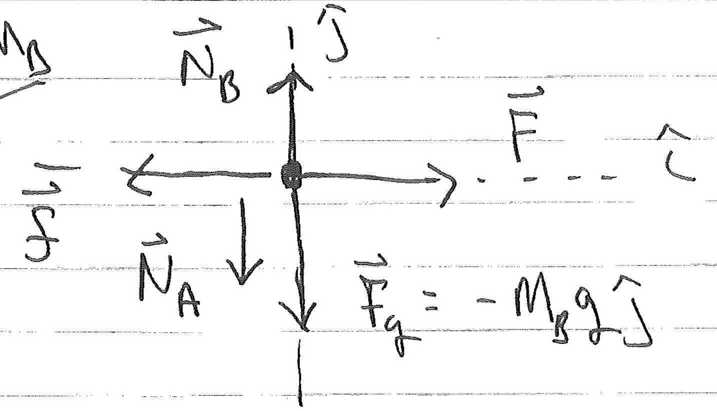
2nd

$\boxed{\hat{i}}$

Not 0

$\sum F_x = M_A a_x$

for M_B



$\vec{F} = F\hat{i}$
$\vec{N}_B = N_B\hat{j}$
$\vec{N}_A = -N_A\hat{j}$
$\vec{f} = -\mu_s N_A\hat{i}$
$\vec{F}_g = -M_B g\hat{j}$

$2^{\underline{nd}}$: $\sum \vec{F} = M_B\vec{a}$

$\boxed{\hat{i}}$ $\sum F_x = M_B a_x$

$$\boxed{F - \mu_s N_A = M_B a_x} \quad \boxed{1}$$

$\boxed{\hat{j}}$ $\sum F_y = M_B a_y \rightarrow 0$

$$N_B - N_A - M_B g = 0$$

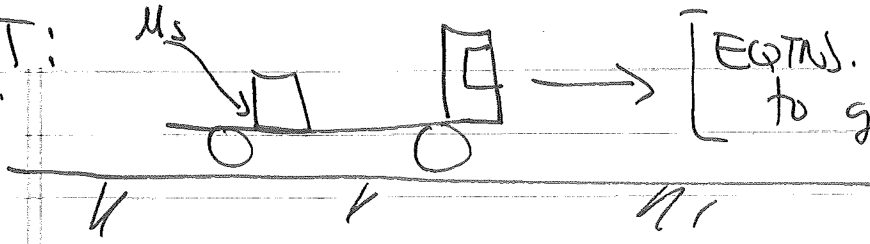
$$\boxed{N_B = N_A + M_B g} \quad \boxed{2}$$

What would change about FBD for block M_A if the blocks were moving to the right @ a constant* speed?

$\sum F_x = M_A a_x \leftarrow$ must be zero *

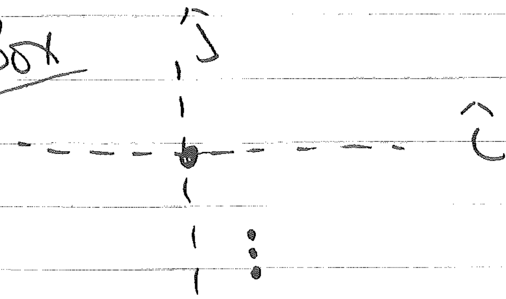
$\therefore$ $\underline{\underline{\vec{f} = 0}}$

HINT:



[EQTNS. of MOTION to get acceleration]

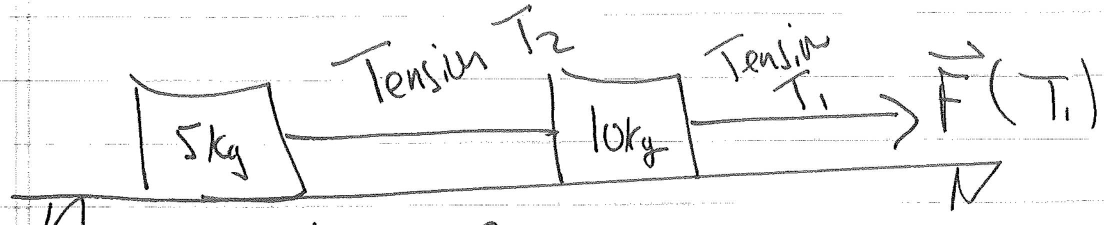
for Box



(M_A in last example) :-)

Apply 2nd
⋮

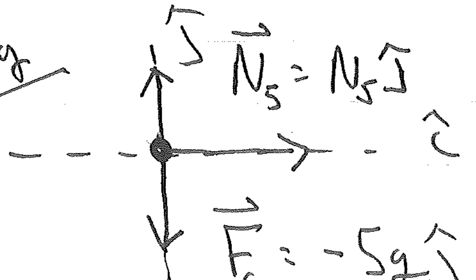
Massless Ropes and Tension : 1 rope, 1 tension



NO FRICTION

If acceleration is $5\ m/s^2$, what is the tension in each rope? Find the normal force on each block.

for 5kg



$\vec{N}_5 = N_5\hat{j}$

$\vec{T}_2 = T_2\hat{i}$

$\vec{F}_g = -5g\hat{j}$

2^{nd} $\sum \vec{F} = 5\vec{a}$

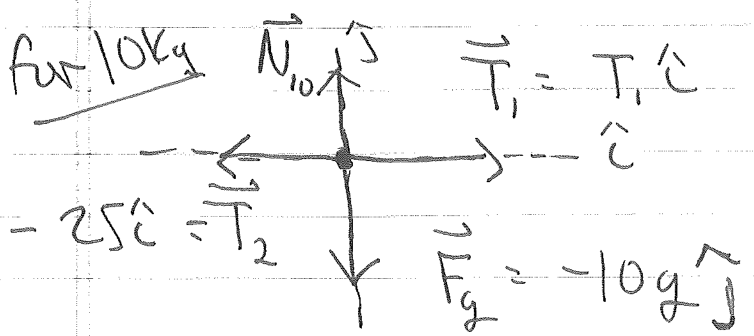
$\boxed{\hat{j}}$ $\sum F_y = 5\cancel{a_y}^{\,0}$

$+N_5 - 5g = 0$

$\boxed{N_5 = 5g}$ Answer

$\boxed{\hat{i}}$ $\sum F_x = 5a_x$

$T_2 = 5(5) = \underline{\underline{25 \text{ newtons}}}$ Answer



$\vec{N}_{10} = +N_{10}\hat{j}$

2^{nd} $\sum \vec{F} = 10\vec{a}$

$\boxed{\hat{i}}$ $\sum F_x = 10a_x$

$-25 + T_1 = 10(5)$

$T_1 = \underline{\underline{75\ N}}$ Answer.