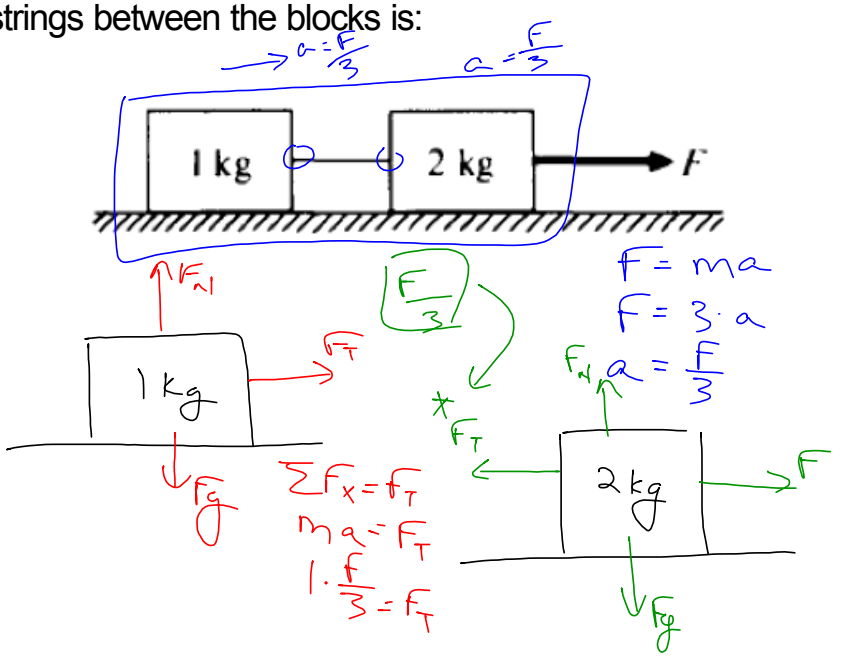
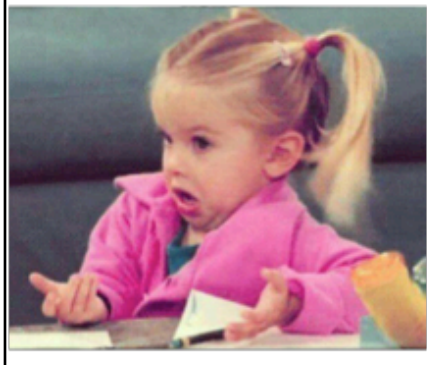
Warm - Up: Monday, October 17th

When the frictionless system shown is accelerated by an applied force of magnitude, the tension in the strings between the blocks is:

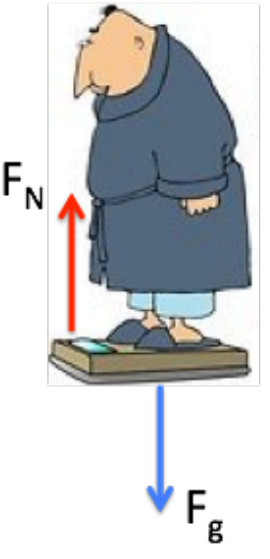
~~A. 2F~~
~~B. F~~
C. 2/3 F
~~D. 1/2 F~~
E. 1/3 F



Bathroom Scales



- So how does a bathroom scale actually measure you?



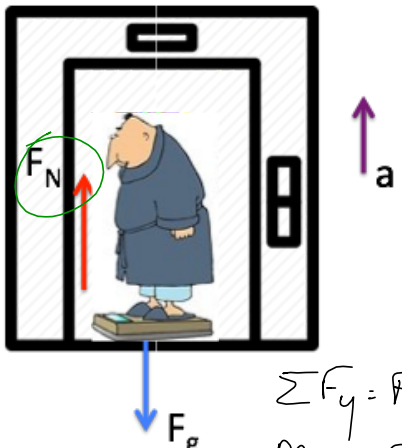
- Measures the normal force needed to support you.

- Equilibrium is good, but what if the force of gravity wins?

Bathroom Scale in Elevators (why not?!)

- Let's see what happens if we put the scale in the elevator

Going Up

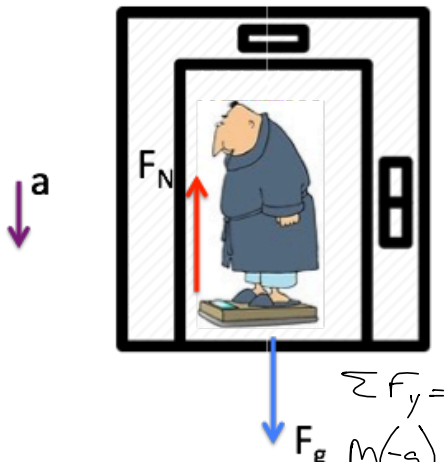


$\Sigma F_y = F_N - F_g$

$ma = F_N - F_g$

$ma + F_g = F_N$

Going Down



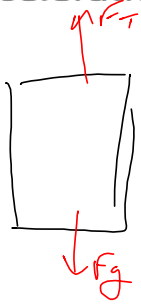
$\Sigma F_y = F_N - F_g$

$m(-a) = F_N - F_g$

$F_g - ma = F_N$

Example 11

The cable supporting a 2,125 kg elevator has a maximum strength of 21,750 N. What maximum acceleration can it give the elevator without breaking? Indicate both the magnitude and direction of this acceleration.



a

$\Sigma F_y = F_T - F_g$

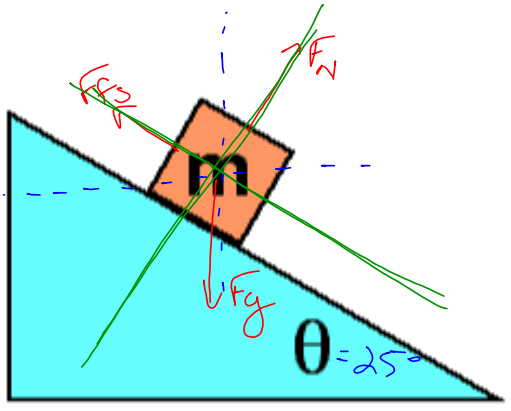
$ma = F_T - F_g$

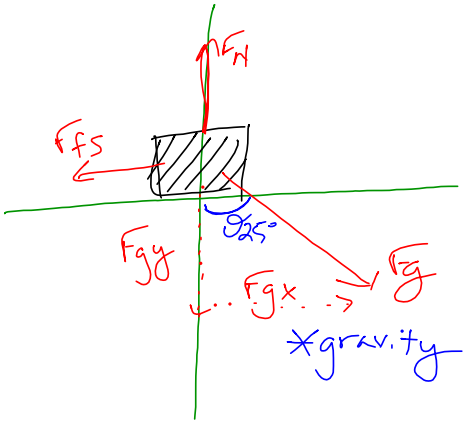
$a = \frac{F_T - F_g}{m}$

$a = \frac{21{,}750 - (2125)(9.8)}{2125}$

$a = 0.447\ m/s^2$

- Tricks for problems on inclines…..





*Tilt our axis

Example 12

A ~~75.0~~ 70.0 kg box slides down a 25.0° ramp with an acceleration of 3.60 m/s²

Equilibrium or Non-equilibrium ΣF_x: $\Sigma F_x = ma$

Equilibrium or Non-equilibrium ΣF_y: $\Sigma F_y = 0$

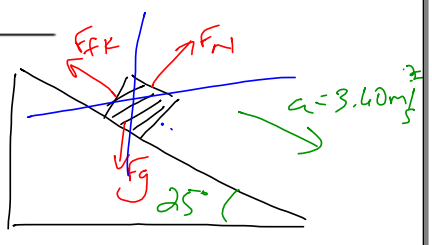
A. Draw a FBD and an 'adjusted' FBD

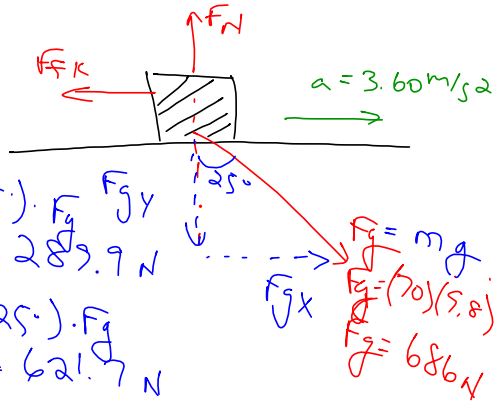
B. Calculate the components for the force of gravity

C. Write a statement for ΣF_x and ΣF_y

D. Calculate the value of the normal force

E. What is the coefficient of kinetic friction (μ_k)





$\Sigma F_x = F_{gx} - F_{fK}$ $\quad \Sigma F_y = F_N - F_{gy}$

$ma = F_{gx} - F_{fK}$ $\quad 0 = F_N - F_{gy}$

$ma = F_{gx} - \mu_K \cdot F_N$ $\quad F_{gy} = F_N$

$(70)(3.60) = 289.9 - \mu_K(621.7)$ $\quad \boxed{F_N = 621.7 N}$

$\mu_K = 0.061$

$F_{gx} = \sin(25°) \cdot F_g$ $\quad F_{gy} = \cos(25°) \cdot F_g$

$F_{gx} = 289.9 N$ $\quad F_{gy} = 621.7 N$