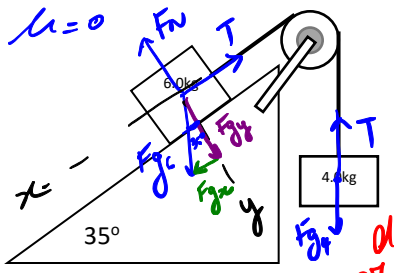
Name: _____ Phys 12

3.3 Inclines (part 2)

Last class we dealt with a single mass on an incline. What happens if we look at 2 masses tied together on these incline planes?

Which direction will the system (2 masses) move? Draw your FBDs!!



mass ✓ angle ✓ determine direction of $\vec{a}$.

Calculate which force is stronger, F_{gx} or F_{g4}?

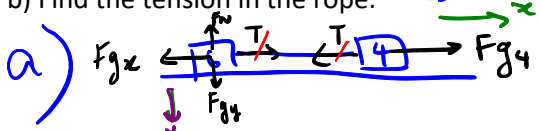
$F_{gx} = 6g\sin 35 = 33.72..N$

$F_{g4} = 4g = 39.2..N$ bigger! ∴ will move to the right

Ex. 1:

a) Calculate the acceleration of the masses.

b) Find the tension in the rope.



x: $F_{net} = ma \rightarrow m_{total}a = F_{g4} - F_{gx}$

$a = \frac{4g - 6g\sin 35}{6+4} = 0.55 m/s^2$ to the right

b) For 4.0kg mass:

$F_{net} = ma$

$4a = F_{g4} - T$

$+T \quad +T$

$T + 4a = F_{g4}$

$-4a \quad -4a$

$T = F_{g4} - 4a = 4g - 4a$ (a from a)

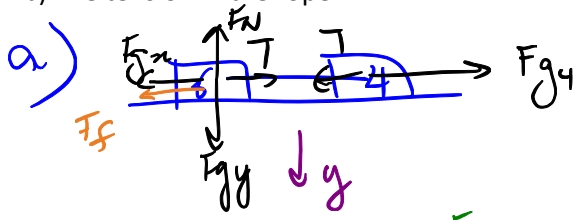
$= 4(9.8) - 4(0.54..)$

$= 137N$

Ex. 2: What if there is friction? If the coefficient of friction on the ramp is ~~0.15~~ 0.09, calculate:

a) The acceleration of the masses

b) The tension in the rope



x: $F_{net} = m_T a = F_{g4} - F_{gx} - F_f$

$m_T a = 4g - 6g\sin 35 - \mu F_N$

y: $F_N = F_{gy}$

$m_T a = 4g - 6g\sin 35 - \mu F_{gy}$

$a = \frac{4(9.8) - 6(9.8)\sin 35 - 0.09(6)(9.8)\cos 35}{10}$

$= 10.11 m/s^2$ to the right

b) 4.0kg:

$F_{net} = ma$

$ma = F_{g4} - T$

→ rearrange for T →

$T = F_{g4} - ma$

$= 4g - 4(0.11..m/s^2)$

$= 39N$

Key strategies: [1] Find which mass is the "winner" in the tug-o-war. [2] Force of friction acts against the object's direction of motion. [3] You can analyze the entire system or only analyze one mass at a time to write your F_{net} equations.

HW: Worksheet 3.3 ALL