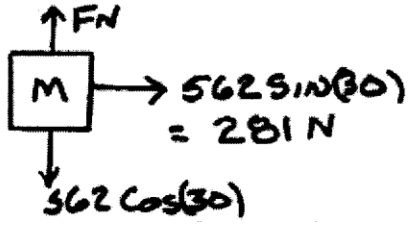
Incline Problems

Draw free body diagrams (FBD's) for each problem and show all work!

1. A 562 N crate is placed on a frictionless inclined plane that makes an angle of 30° with the horizontal. What is the acceleration of the crate as it slides down the plane?



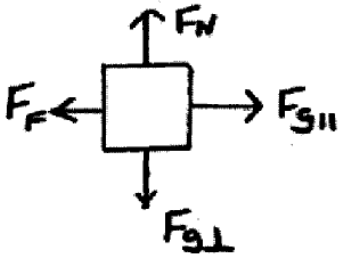
$M = \frac{562}{9.8} = 57.3\ kg$

$F_{NET} = ma$

$281 = 57.3a$

$a = \frac{281}{57.3} = 4.9\ m/s^2$

2. A 2 kg glider slides down a plane inclined to 50° with the horizontal. If the force of friction between glider and plane is 5.0 N, find the acceleration of the glider. (Hint: the force of friction always acts opposite the direction of movement.)



$F_{NET_{||}} = ma_{||}$

$F_{G||} - F_F = ma_{||}$

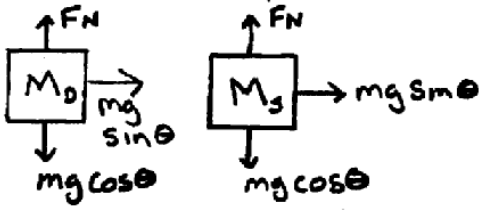
$mg\sin 50 - 5.0 = 2a$

$2(9.8)\sin 50 - 5 = 2a$

$15 - 5 = 2a$

$a = \frac{10}{2} = 5\ m/s^2$

3. A 60 kg father is skiing down a run with his 30 kg son. If the slope is inclined at 10° to the horizontal find each person acceleration. Neglect friction. (Hint: Draw two separate FBD's)



$F_{NET} = Ma$

$M_D g \sin 10° = M_D a$

$g \sin 10° = a$

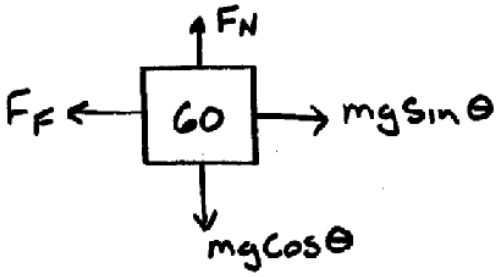
$a = 9.8 \sin 10°$

$a = 1.70\ m/s^2$

4. Explain your answers to 3.

Mass cancels out

5. Mr. S (mass = 60 kg) is downhill skiing with a constant velocity. Calculate the coefficient of friction (μ) between his skis and the snow if the hill is inclined 30°.



$F_N - mg\cos\theta = 0$

$F_N = 60(9.8)\cos 30 = 509\ N$

$F_F = \mu F_N = 509\mu$

$F_{NET_x} = mg\sin\theta - F_F = 0$

$60(9.8)\sin(30) = 509\mu$

$\mu = \frac{242}{509} = 0.58$