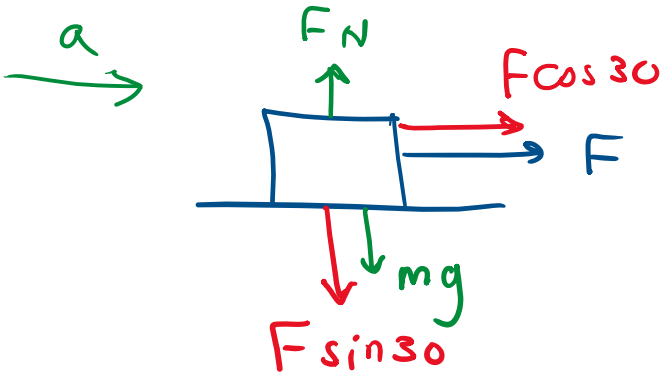
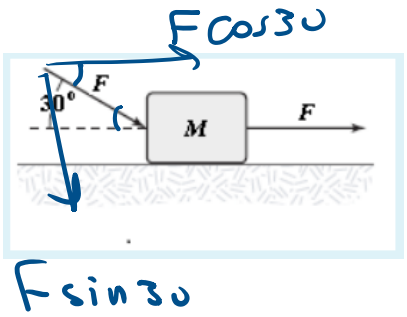
1) The horizontal surface on which the block slides is frictionless. If F = 20 N and M = 5.0 kg, what is the magnitude of the resulting acceleration of the block? (Ans: 7.5m/s^2)





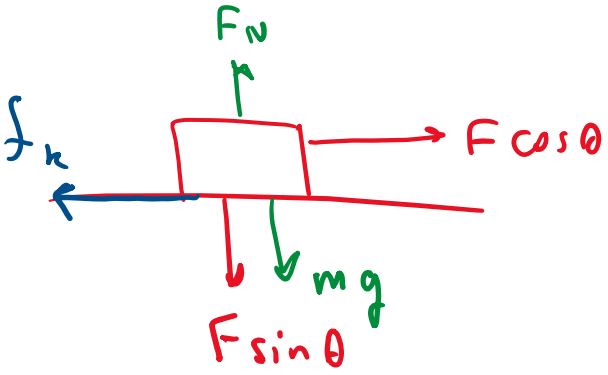
$$F_{net} = ma$$

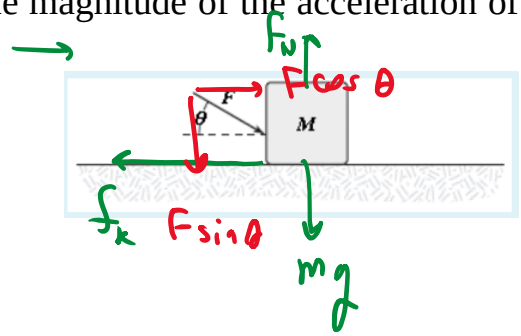
$$F\cos 30 + F = ma$$

$$a = \frac{F(\cos 30 + 1)}{m} = \frac{20(\cos 30 + 1)}{5} \ m/s^2$$

2) A block is pushed across a horizontal surface by the force shown. If the coefficient of kinetic friction between the block and the surface is 0.30, F = 20 N, θ = 30°, and M = 3.0 kg, what is the magnitude of the acceleration of the block? (Ans: 1.8m/s^2)

$\mu_k = 0.3$





$F_{net_y} = 0$

$F_N - mg - F\sin\theta = 0$

$F_N = mg + F\sin\theta$

$F_{net_x} = ma$

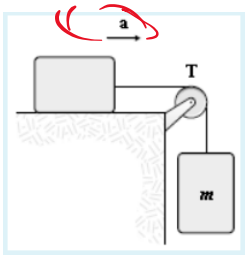
$F\cos\theta - f_k = ma$

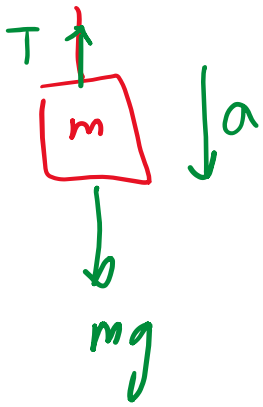
$F\cos\theta - \mu_k F_N = ma$

$$a = \frac{F\cos\theta - \mu_k(mg + F\sin\theta)}{m}$$

$$a = \frac{20\cos 30 - 0.3(3\times 9.8 + 20\sin 30)}{3} \quad m/s^2$$

3) If the tension, ***T***, is 15 N and the magnitude of the acceleration, ***a***, is 3.0 m/s^2, what is the mass, ***m***, of the suspended object? Assume that all surfaces and the pulley are frictionless. (Ans: 2.2 kg)





$$F_{net} = ma$$

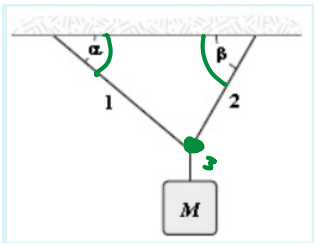
$$T - mg = m(-a)$$

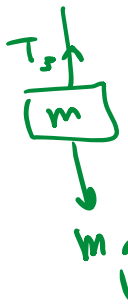
$$T = mg - ma$$

$$T = m(g - a)$$

$$m = \frac{T}{g - a} = \frac{15}{9.8 - 3} \text{ kg}$$

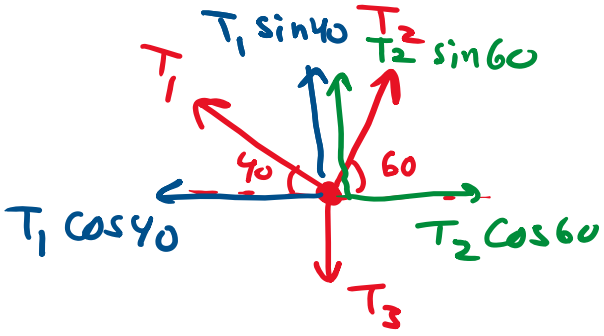
4) If $\alpha = 40°$, $\beta = 60°$, and $M = 4.0$ kg, determine the tension in string 1. (Ans: 20N)





$$F_{net} = ma = 0$$

$$T_3 - mg = 0 \quad \text{or} \quad \boxed{T_3 = mg}$$



x-axis : $F_{net} = 0$

$$T_2 \cos 60 - T_1 \cos 40 = 0$$

$$T_2 = T_1 \frac{\cos 40}{\cos 60}$$

y-axis : $F_{net} = 0$

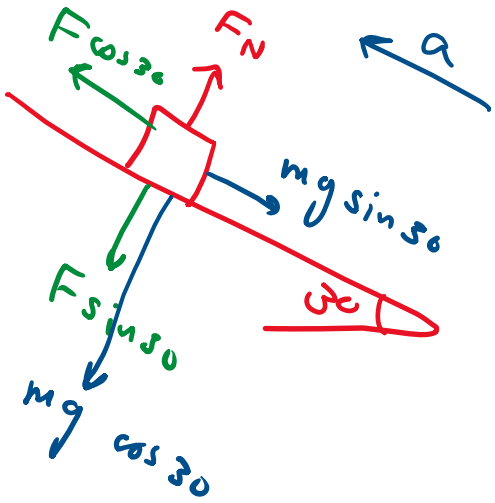
$$T_1 \sin 40 + T_2 \sin 60 = T_3 = mg$$

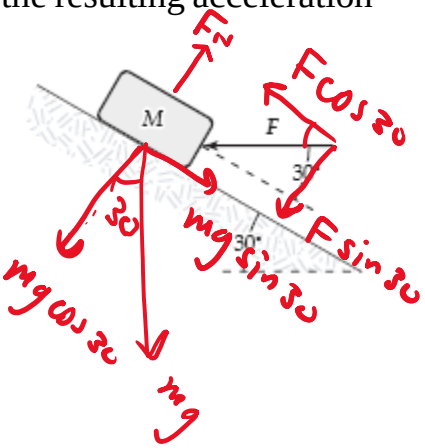
$$T_1 \sin 40 + T_1 \frac{\cos 40}{\cos 60} \sin 60 = mg$$

$$T_1 (\sin 40 + \cos 40 \tan 60) = mg$$

. . .

5) A block is pushed up a frictionless 30° incline by an applied force as shown. If F = 25 N and M = 3.0 kg, what is the magnitude of the resulting acceleration of the block? (Ans: 2.32 m/s^2)





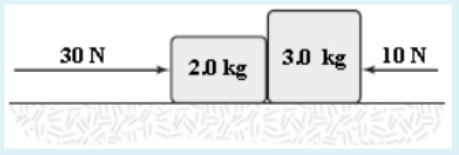
$$F_{net} = ma$$

$$mg\sin 30 - F\cos 30 = m(-a)$$

$$a = \frac{F\cos 30 - mg\sin 30}{m} = \frac{25\cos 30 - 3\times 9.8\sin 30}{3}$$

m/s^2

6) Two blocks in contact with each other are pushed to the right across a rough horizontal surface by the two forces shown. If the coefficient of kinetic friction between each of the blocks and the surface is 0.30, determine the magnitude of the force exerted on the 2.0-kg block by the 3.0-kg block.
(Ans: 22N)



+15

7) A 5.0-kg mass is suspended by a string from the ceiling of an elevator that is moving upward with a speed which is decreasing at a constant rate of 2.0 m/s in each second ($a=2.0\ m/s^2$). What is the tension in the string supporting the mass? (Ans: 39N)

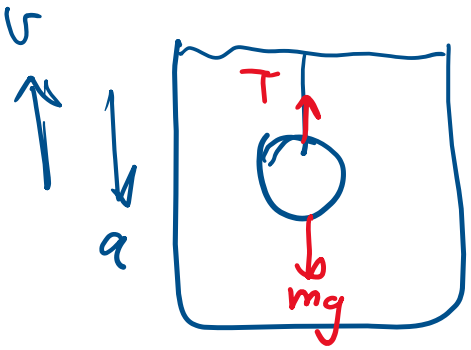
$F_{net} = ma$

$T - mg = m(-a)$

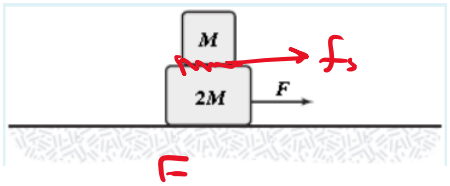
$T = mg - ma$

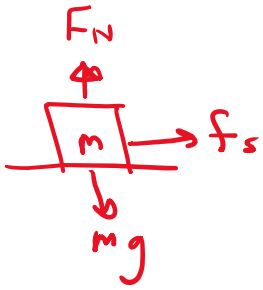
$= m(g - a)$

$T = 5(9.8 - 2)$ N



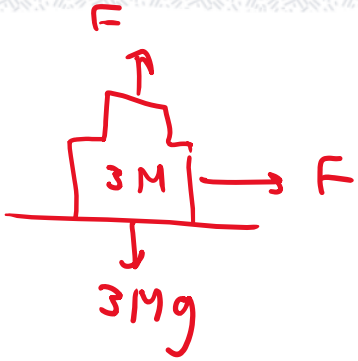
8) Two blocks are accelerated across a horizontal frictionless surface as shown. Frictional forces keep the two blocks from sliding relative to each other, and the two move with the same acceleration. If F = 1.2 N and M = 1.0 kg, what is the horizontal component (frictional force) of the force of the large block on the small block? (Ans: 0.4N to the right)





$f_s = ma$

$f_s = 1(0.4) = 0.4\ N$



$F = 3Ma$

$a = \frac{F}{3M} = \frac{1.2}{3(1)}$

$a = 0.4\ m/s^2$