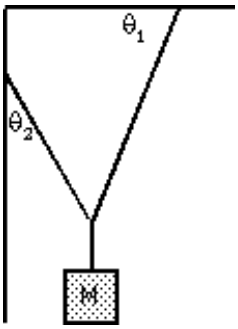
HW#3: Forces in Equilibrium



1.Find the tensions in the two strings if the mass is 10 kg and the angles are:
a. $\theta_1 = 60°$; $\theta_2 = 60°$
b. $\theta_1 = 53°$; $\theta_2 = 45°$ [T_1=49.2N,T_2=85.2N]
c. $\theta_1 = 45°$; $\theta_2 = 60°$

2. In figure 2 what is the value of the unknown weight to achieve equilibrium, if $M_B = 25$ kg, $\theta_1 = 130°$, and $\theta_2 = 37°$.

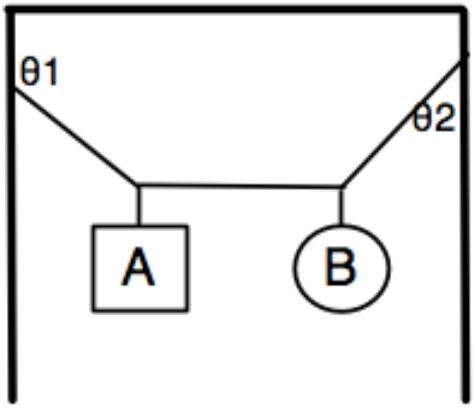
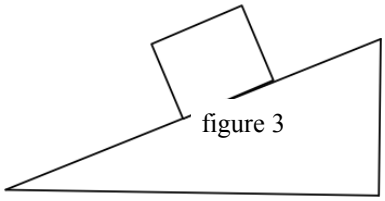


figure 2

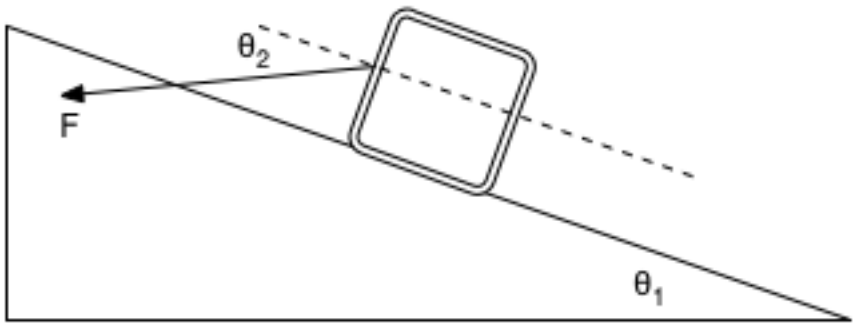
a. What are the tensions. [T_1=241.0 N, T_2=184.6 N, T_3=306.8B]
b. What is the mass? [15.8 kg]
Does the length of the middle string make a difference?



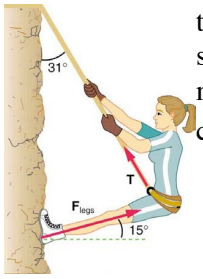
3.If the static friction coefficient between the block and an incline in figure 3 is 0.4, to what angle must you raise the incline in order for the block to start sliding? Once the block is sliding, to what angle must the incline be lowered if the block is to go at constant speed given μ_k=0.3? [$\theta_1 = 21.8°$; $\theta_2 = 16.7°$]

4. What amount of force parallel to the incline is needed to push the block up the incline at a constant velocity? Assume that the block has a mass of 10 kg, the coefficient of friction is 0.4, and the incline is sloped at the same angle as in the second part of problem 3. [F = 65.7N]

5. As shown in figure 4, a 10 kg block is pulled up a 30° (θ_1) incline at a constant velocity by a 100 N force directed at 35° (θ_2) below the plane of the incline. What is the coefficient of friction between the block and the incline? [μ=0.231]



6. Consider the 52.0-kg mountain climber in Figure. (a) Find the tension in the rope and the force that the mountain climber must exert with her feet on the vertical rock face to remain stationary. Assume that the force is exerted parallel to her legs. Also, assume negligible force exerted by her arms [T = 512 N]. (b) What is the minimum coefficient of friction between her shoes and the cliff? (μ=0.268)



7. What would have to be the minimum weight of block A, as shown in figure 6, for it to be pulled up the incline by the hanging 5 lb block at constant speed if $\mu_k = 0.35$ and $\theta = 37°$? [5.68 lb]