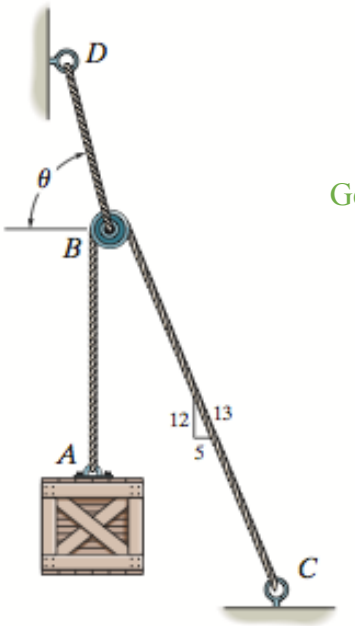
TAM 211 Written Assignment 5 (due Thursday, Apr 12th)

The **OBJECTIVE** of this written assignment is to practice **drawing free-body diagram (FBD)** and **writing equations of equilibrium (EoE)**.

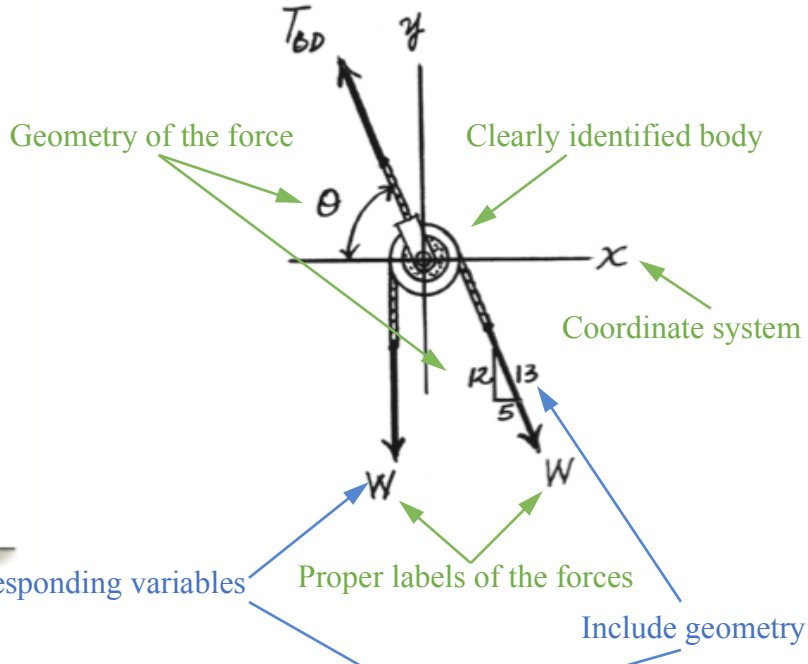
DIRECTION: On each problem solution page, use the top half to clearly draw out a large FBD of the specified body/bodies, and the bottom half to write the corresponding equations of equilibrium with given geometry for the diagram. DO NOT SOLVE THE PROBLEM.

General "Written Assignment Instructions" applies. Additional grading criteria includes: 1) proper use of page space for FBD and EoE; 2) properly labeled external forces on the body; 3) properly labeled geometry of the forces; 4) coordinate system; 5) variables and geometry in EoE correspond to FBD.

Sample Problem: The cord *BD* can support a maximum load of *T*. Perform equilibrium analysis on pulley *B* for determining the maximum weight of the crate, and the angle θ for equilibrium. Assume the mass of the pulley is negligible.



Sample FBD Solution

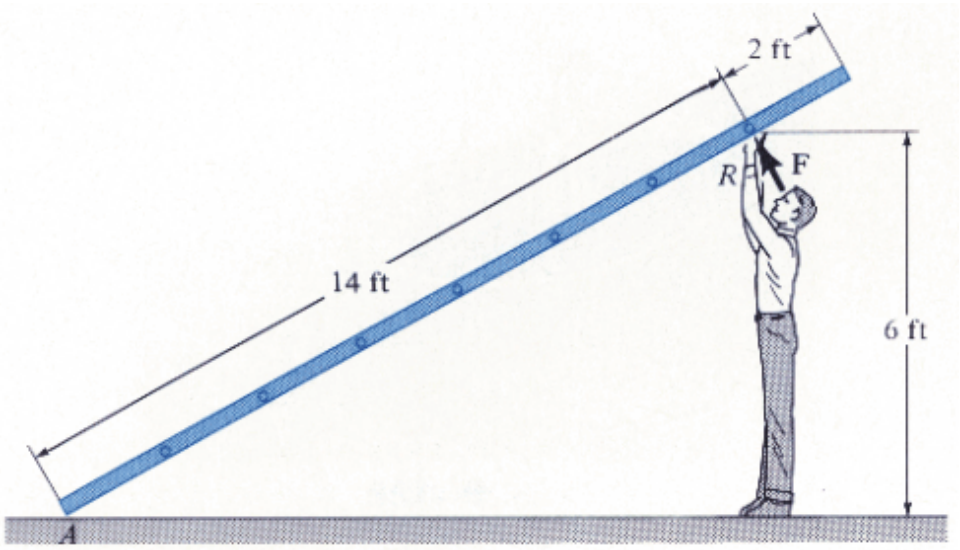


Sample EoE Solution

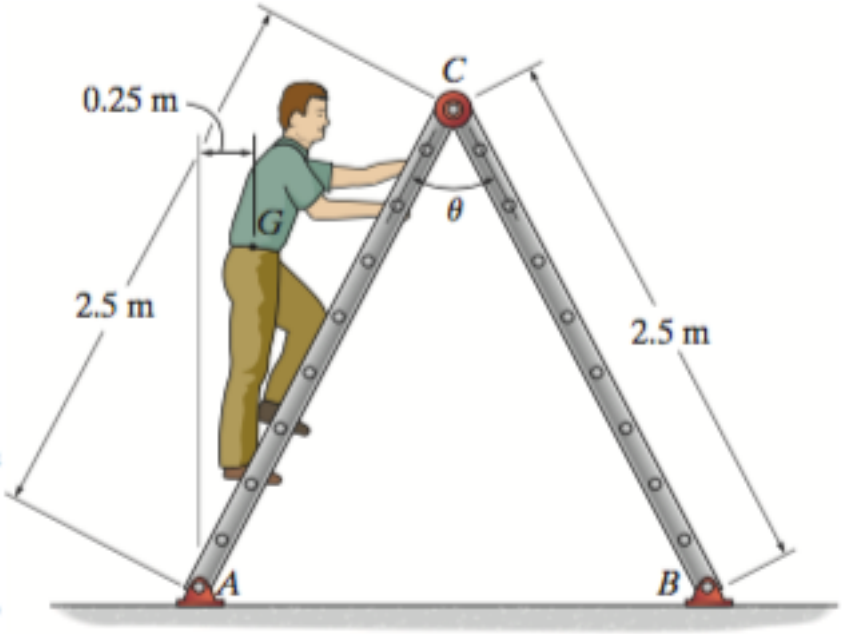
$$\sum F_x = 0 = -T_{BDx} + W_x = -T_{BD}(\cos\theta) + W\left(\frac{5}{13}\right) = 0$$

$$\sum F_y = 0 = T_{BDy} - W - W_y = T_{BD}(\sin\theta) - W - W\left(\frac{12}{13}\right) = 0$$

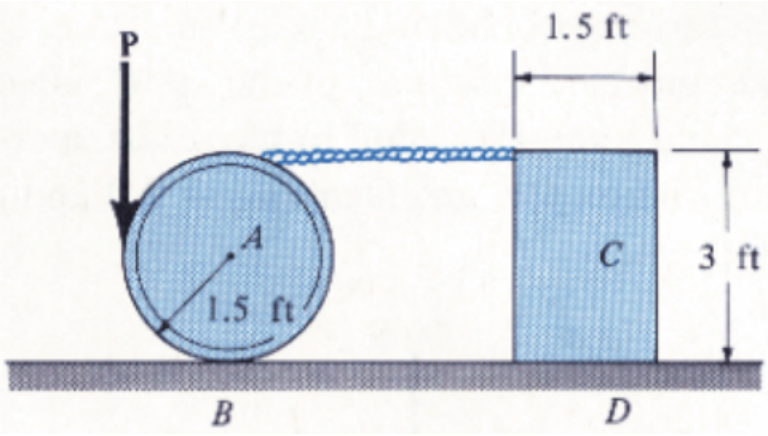
Problems 1: Draw the free body diagrams and write the corresponding equations of equilibrium for when the 16-foot ladder shown below is on the verge of slipping. The ground is not smooth, the coefficient of static friction between the ladder and the ground is μ_s, and the weight of the ladder is W.



Problem 2: Draw the free body diagrams and write the corresponding equations of equilibrium for the ladder and the man (consider them as one body) at equilibrium. The ground is not smooth, the coefficient of static friction between the ladder and the ground is μ_s, and the weights of the man and the ladder are W_m and W_l, respectively.



Problem 3: Draw the free body diagrams and write the corresponding equations of equilibrium for a) cylinder A and b) block C at equilibrium. The ground is not smooth, the coefficient of static friction between the all surfaces is μ_s, and the weights of cylinder A and block C are W_A and W_C, respectively.



Problem 4: Draw the free body diagrams and write the corresponding equations of equilibrium for the man and the belt that tethers him to the pole (consider them as one body) when he is about to slip. The coefficient of static friction between the rope and the pole is μ_{s1}, the coefficient of static friction between the shoes and the pole is μ_{s2}, and the weight of the man is W.