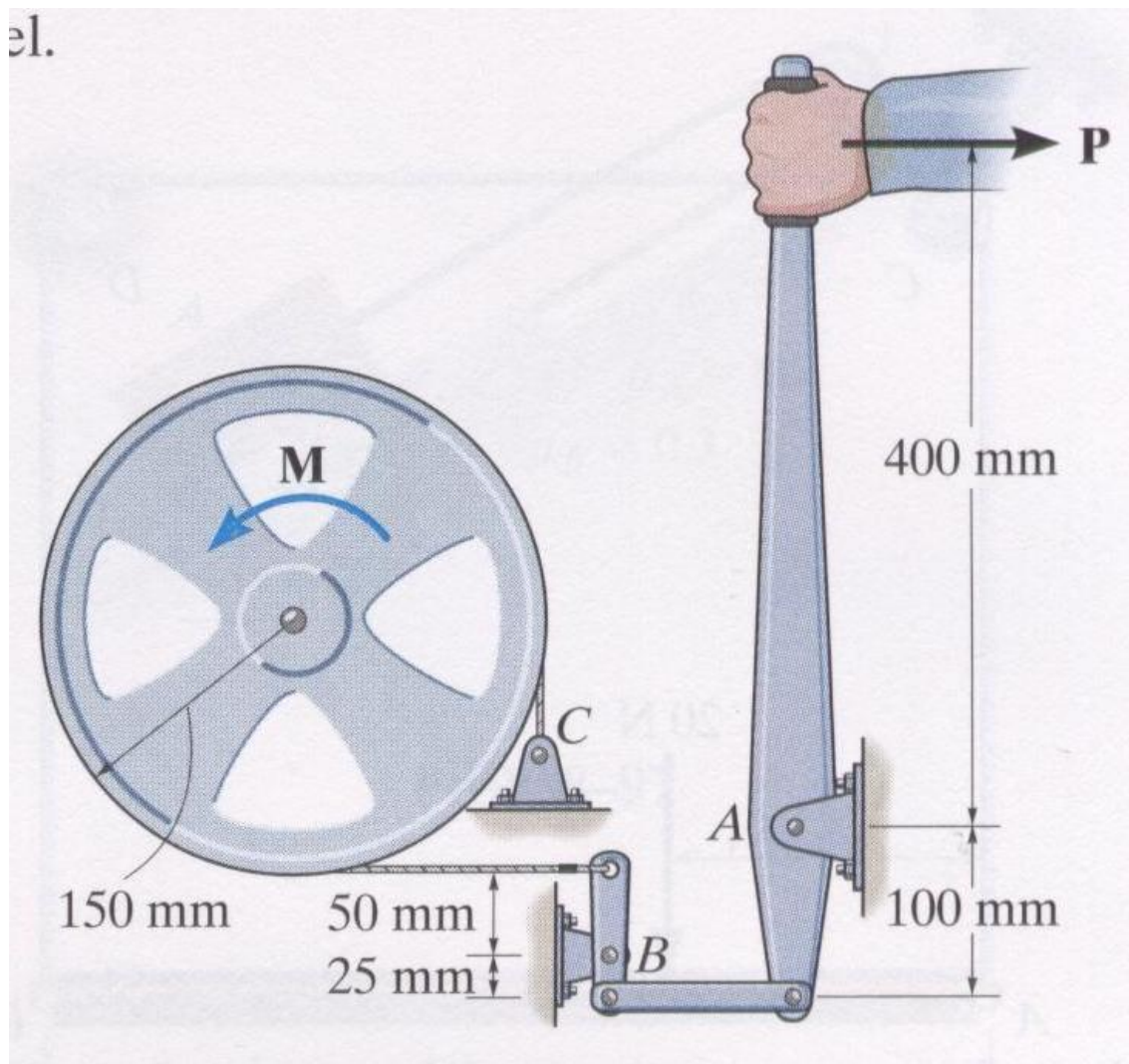


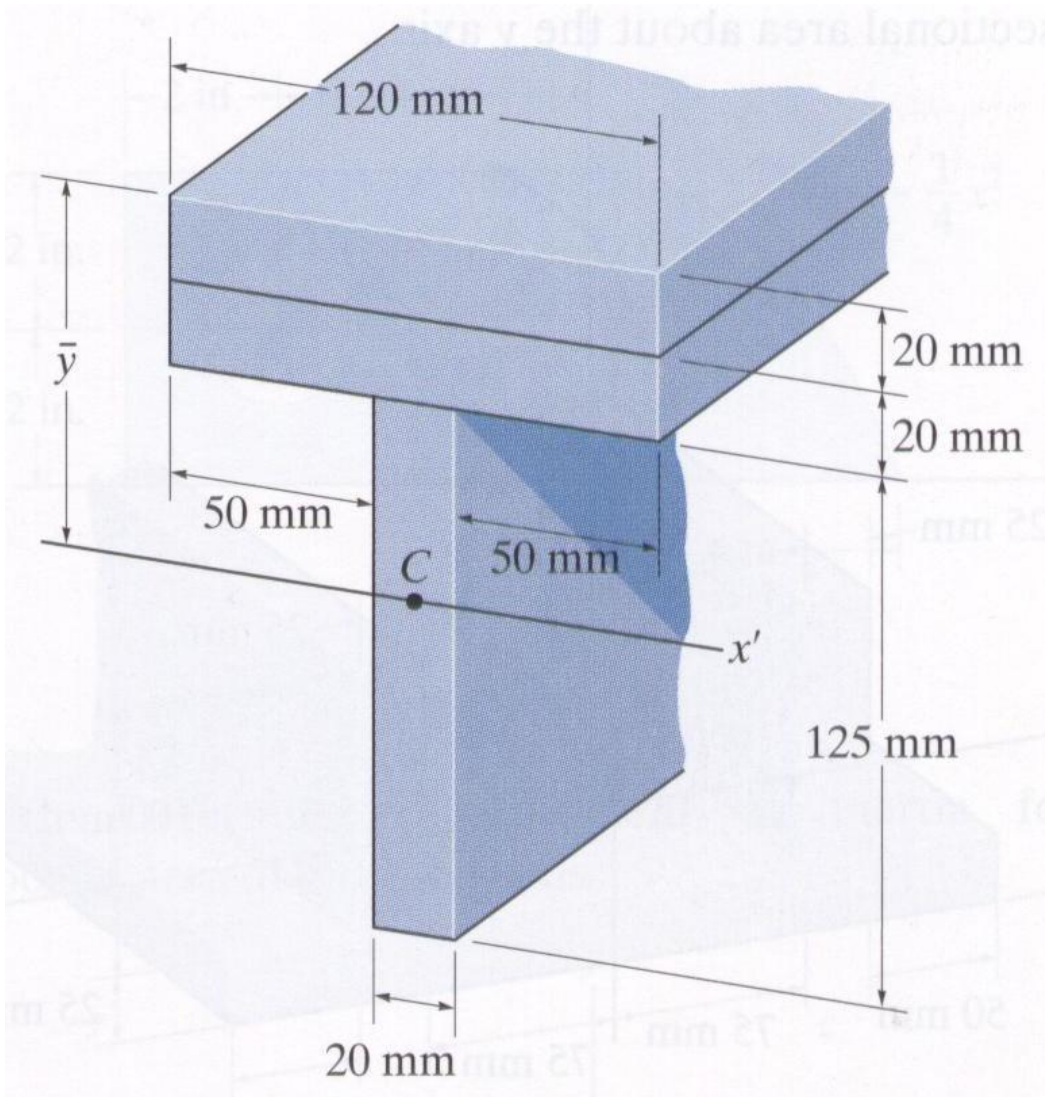
FINAL EXAM

Open Book, Closed Notes, Do not write on this sheet, Show all work

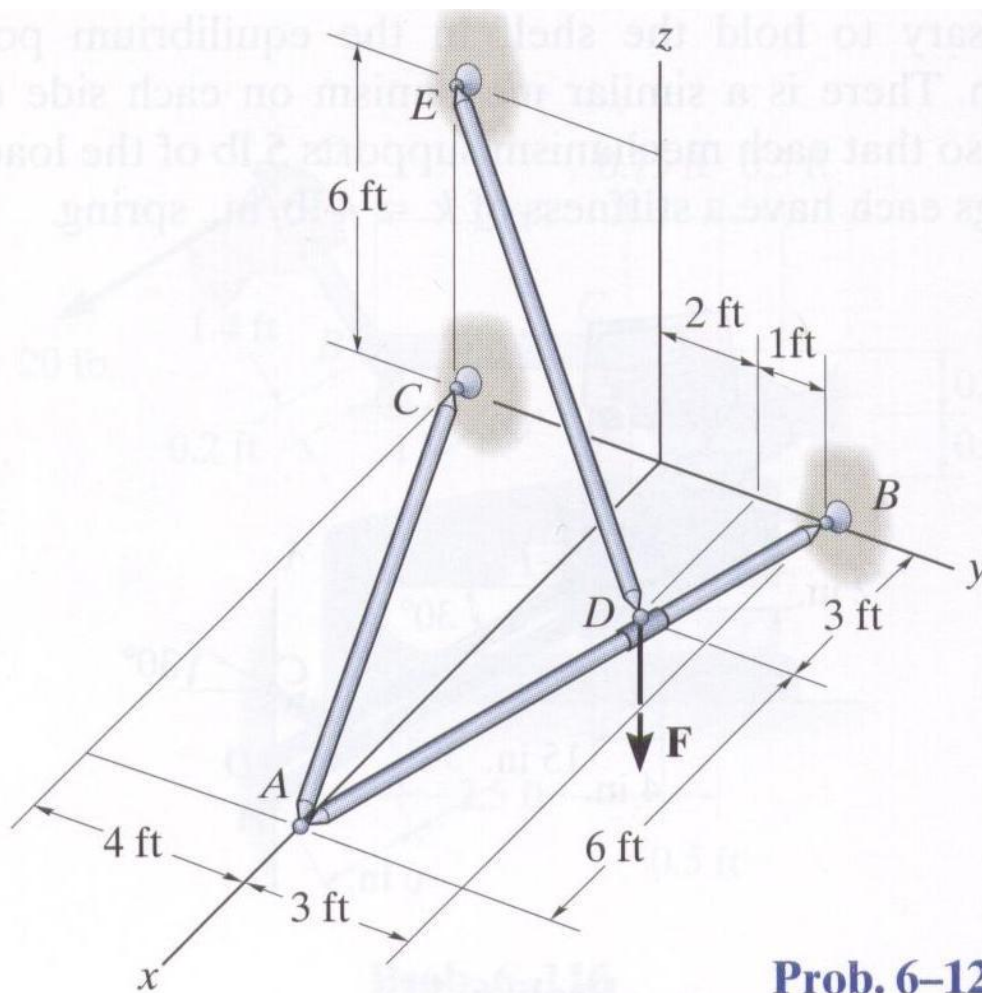
1. (15 points) The wheel is subjected to a torque of $M = 50 \text{ N}\cdot\text{m}$. If the coefficient of kinetic friction between the belt and the rim of the wheel is $\mu_k = 0.3$, determine the smallest horizontal force P that must be applied to the lever to stop the wheel.



2. (25 points) Determine the location \bar{y} of the centroid C of the beam's cross-sectional area. Then compute the moment of inertia for the area about the x' axis.

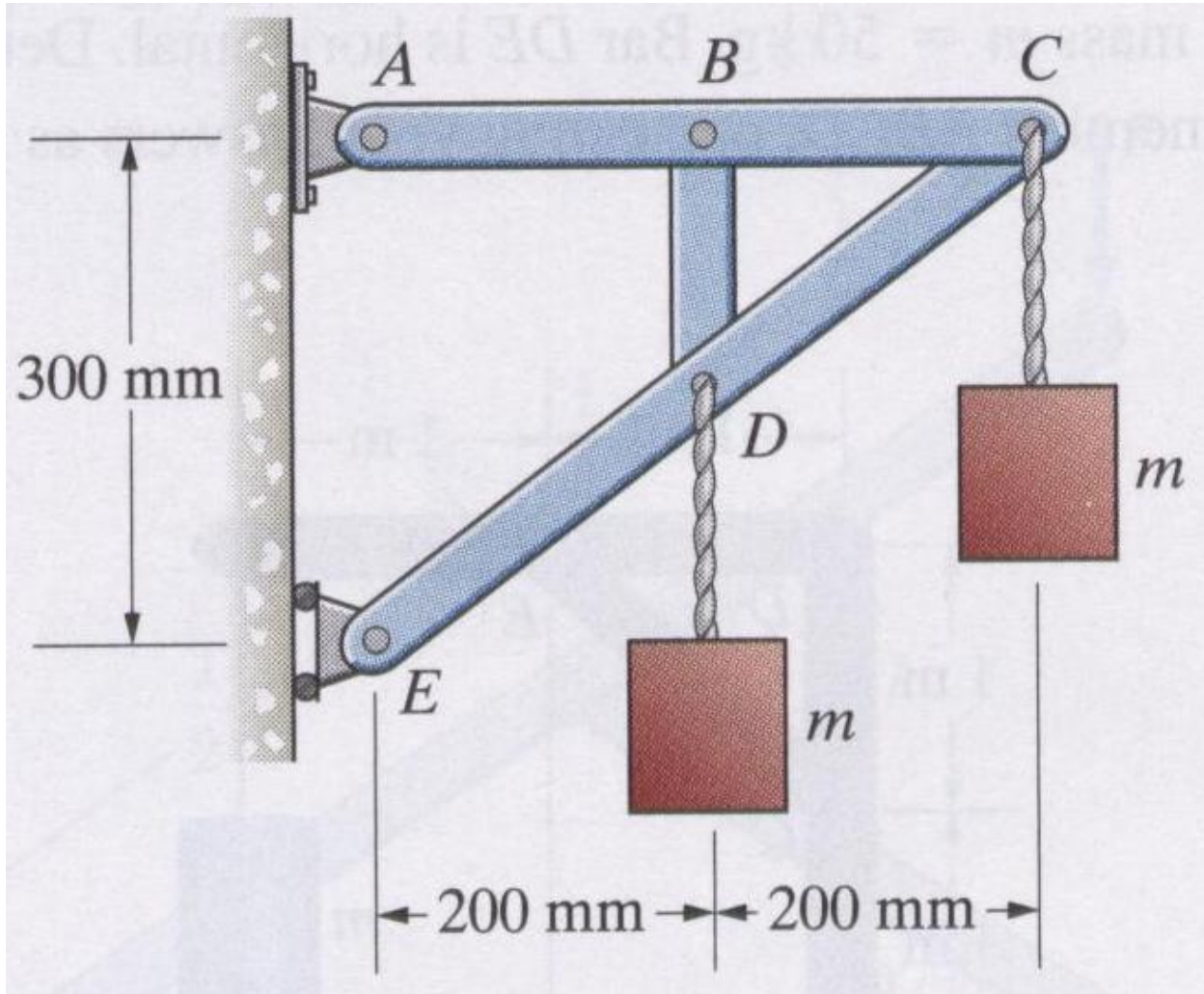


3. (40 points) The three-member frame is connected at its ends using ball-and-socket joints. Determine the x , y , and z components of reaction at B and the tension in member ED . The force acting at D is $\mathbf{F} = \{135\mathbf{i} + 200\mathbf{j} - 180\mathbf{k}\}$ lb.

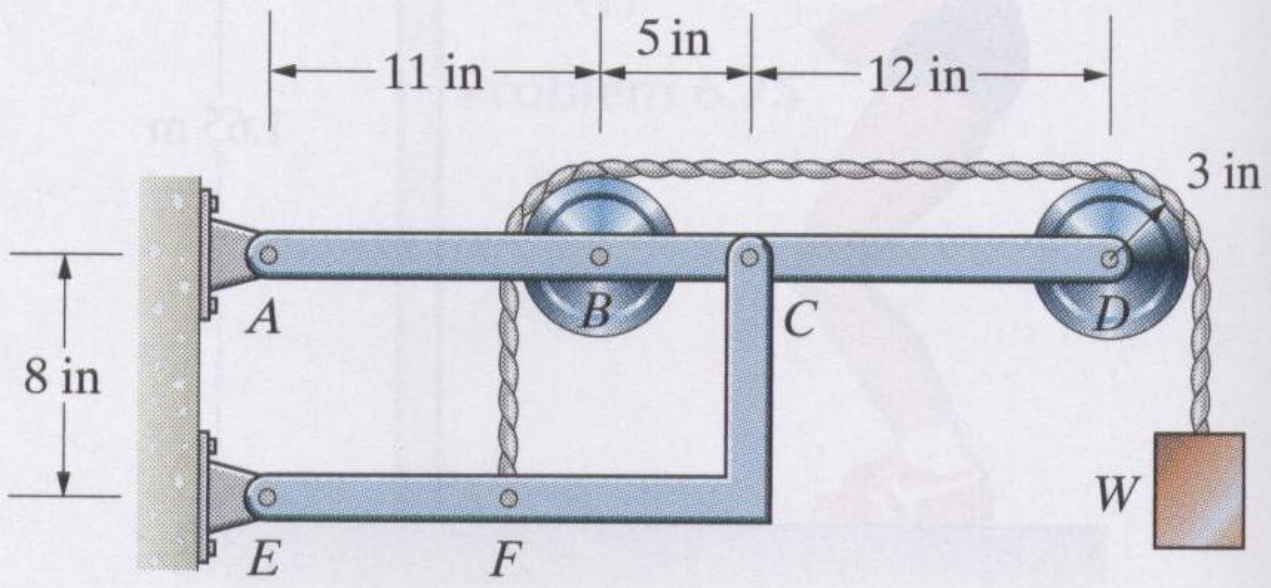


4. (20 points) Draw **all** of the necessary the free-body diagrams for the following situations. Do not solve!

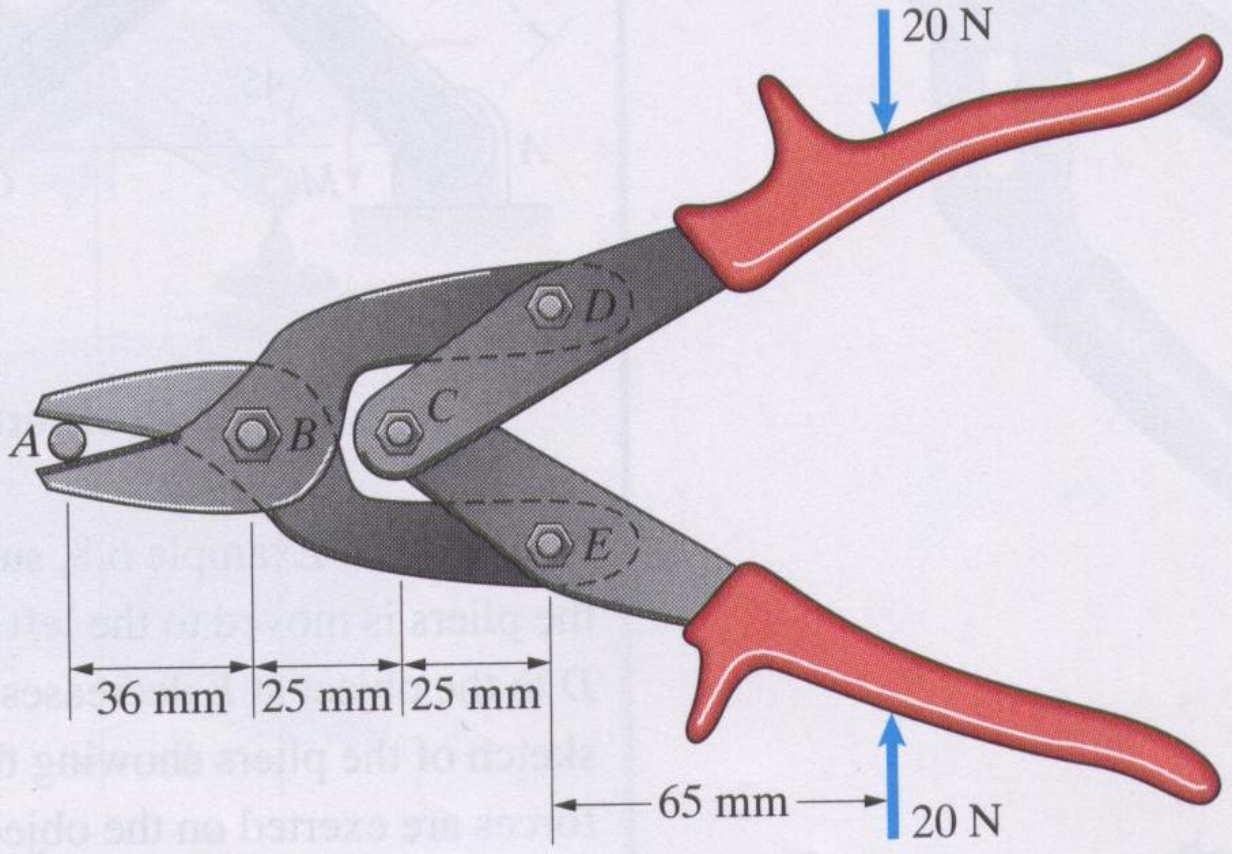
The mass $m = 120$ kg. Determine the forces on member ABC .



The weight $W = 80 \text{ lb}$. Determine the forces on member $ABCD$.



A person exerts 20-N forces on the handles of the shears. Determine the magnitude of the forces exerted on the branch at A.



The structure shown (one of two identical structures that support the scoop of the excavator) supports a downward force $F = 1800\text{ N}$ at G . Determine the reactions on member CDK at K .

