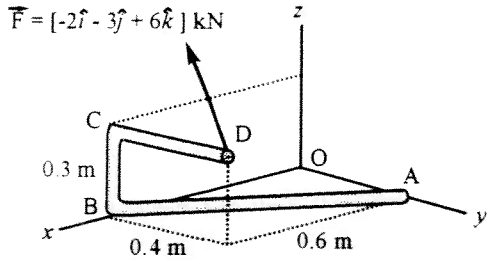
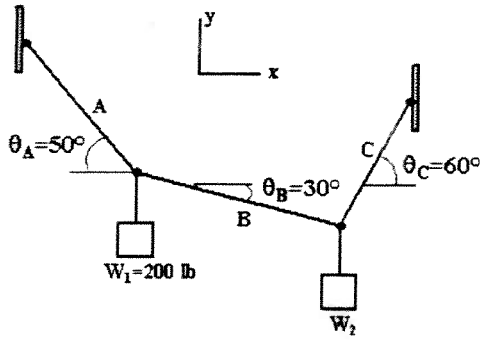
BE 50 –STATICS FINAL EXAMINATION DEPT. AVG = 73.8
Fall Semester 1999

1. A force **F** acts at point D on a pipe frame ABCD as shown. Determine the moment of this force about the pipe segment AB. Express the answer as a Cartesian vector.



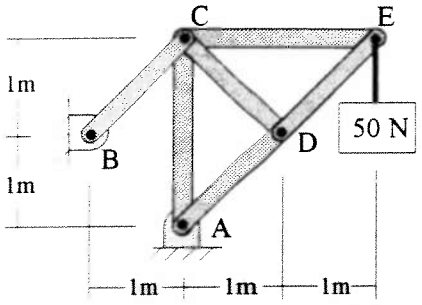
ANS:
$\bar{M}_{AB} = 2.56\,\hat{i} - 1.708\,\hat{j}$ kN·m

2. Determine the tension in cable B and the weight W_2 required for equilibrium of the system.



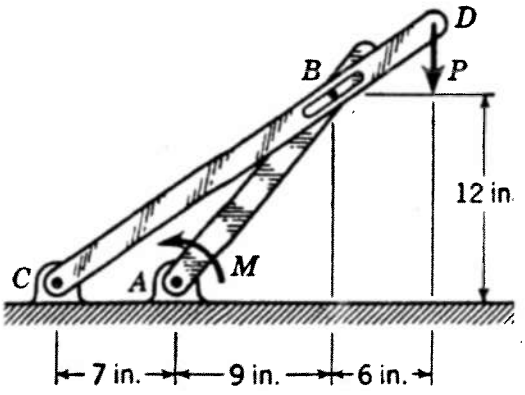
ANS:
$T_B = 375.9$ Lb
$W_2 = 751.8$ Lb

3. Determine the axial forces in the members CA, CD, and CE, and state whether the members are in tension or compression.



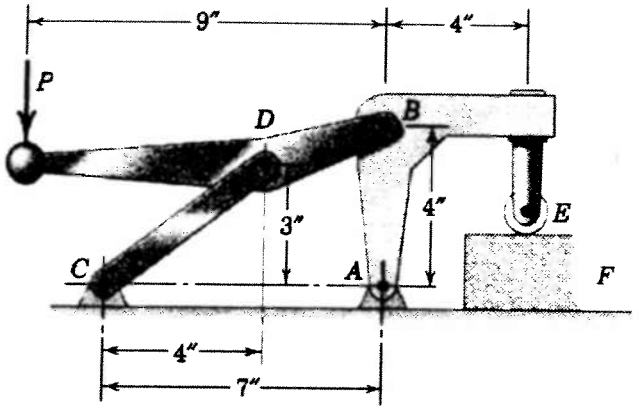
ANS: CD = 0
CE = 50 N (T)
CA = 50 N (C)

4. Members AB and CD are connected by a pin attached to AB which slides freely in a slot in member CD. If a couple of moment M = 450 lb-in is applied to AB as shown, determine the force P required to maintain equilibrium.



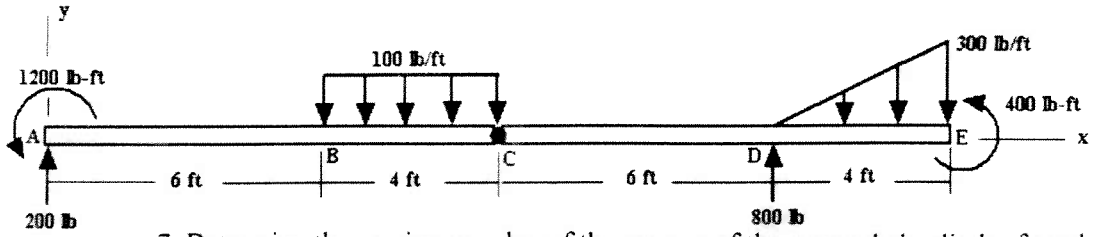
ANS:
P = 28.41 Lb

5. Determine the vertical clamping force at E, which holds the workpiece F in place, when the force P = 10 lb. is applied to the handle of the toggle clamp.



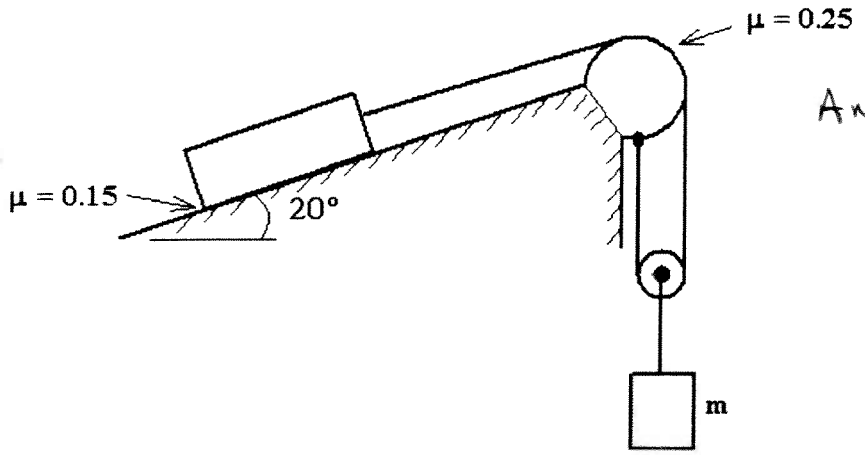
ANS:
F = 72 Lb

6. Draw the complete shear force and bending moment diagrams for the beam ABCDE loaded as shown. You must provide numerical values for all pertinent points on the diagrams. Write the bending moment equation for the region BC (6 ft < x < 10 ft). Note: The reactions have already been determined and point C is a pin joint between two beam sections.



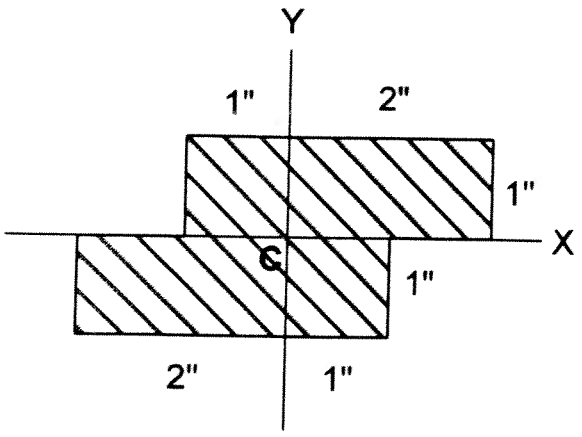
Partial Ans:
$M_{BC} = -50x^2 + 800x - 3000$ Lb-ft

7. Determine the maximum value of the mass **m** of the suspended cylinder for which the system is in equilibrium. The coefficient of friction between the 50-kg block and the incline is 0.15 and that between the cord and fixed peg is 0.25. The pulley is frictionless.



ANS:
m = 78.05 kg

8. Determine the directions of the principal axes with origin at the centroid c, and the principal moments of inertia of the area about these axes. Show and label the principal axes on the figure.



ANS:
$I_{max} = 6.5 \text{ in}^4 \text{ @ } -71.57°$
$I_{min} = 1.5 \text{ in}^4 \text{ @ } 18.43°$