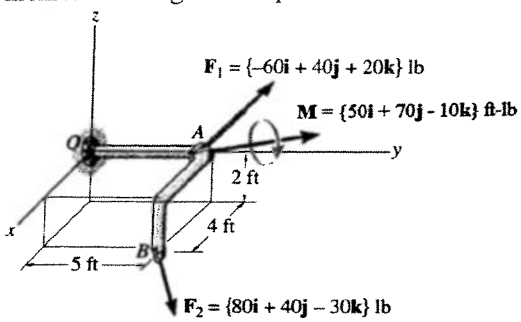
Dept Ave = 72.5%

BE 50 Fall 2001 Final Exam

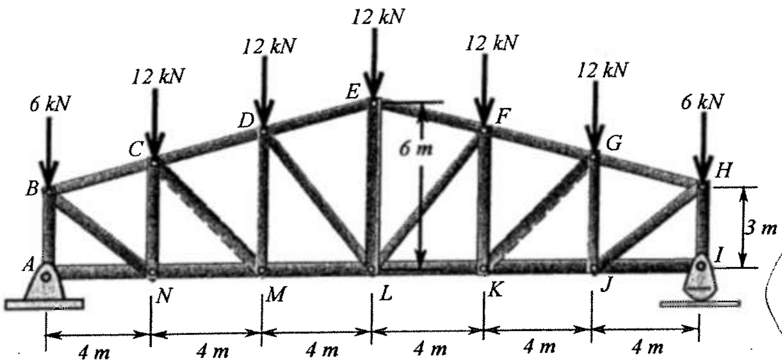
PROBLEM 1 Replace the force and couple-moment system by an equivalent resultant force and couple moment at flange *O*. Express the results in Cartesian vector form.



$\bar{F}_R = 20\hat{i} + 80\hat{j} - 10\hat{k}$ lb

$\bar{M}_o = 80\hat{i} + 30\hat{j} + 50\hat{k}$ ft·lb

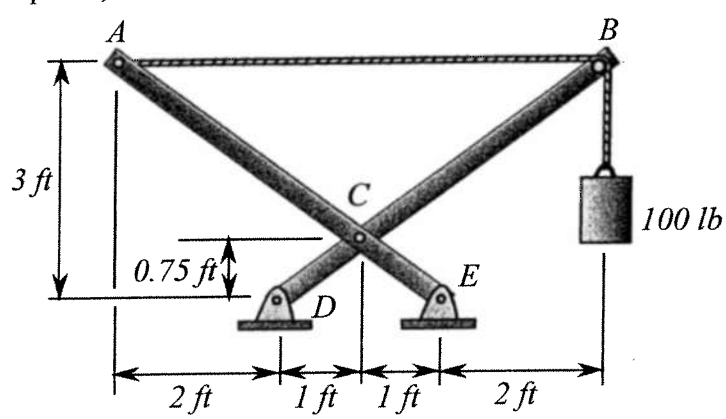
PROBLEM 2 Determine the force in members *EF* and *EL* of the roof truss and state if members are in tension or compression.



$F_{EF} = 37.1$ kN (C)

$F_{EL} = 6$ kN (T)

PROBLEM 3 The two-member frame is pin connected at C, D and E. The cable is attached to A, passes over the smooth peg at B, and is attached to a 100 lb load. Determine the horizontal and vertical reactions at pins C, D and E.

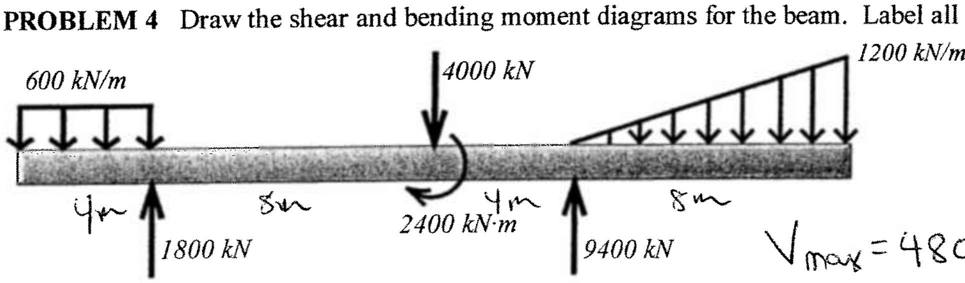


$C_x = 133$ lb $C_y = 200$ lb

$D_x = -33$ lb $D_y = -100$ lb

$E_x = 33$ lb $E_y = 200$ lb

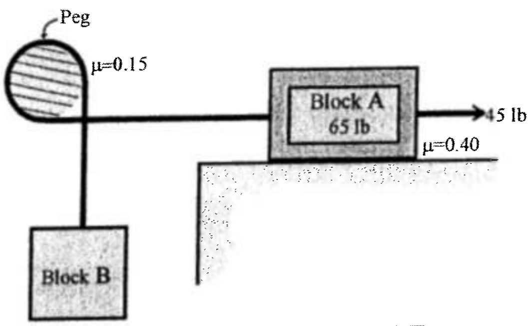
PROBLEM 4 Draw the shear and bending moment diagrams for the beam. Label all critical points.



$V_{max} = 4800$ kN at $X = 16$m

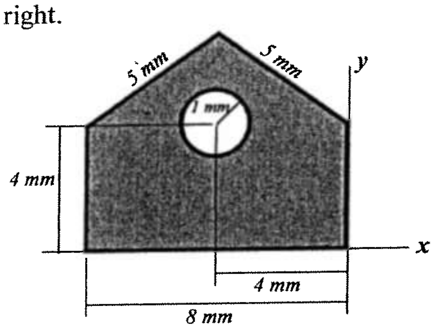
$M = -25{,}600$ kN·m at $X = 16$m

PROBLEM 5 A rope connecting two blocks is wrapped ¾ of a turn around a fixed peg. The coefficient of friction between the peg and the rope is 0.15; between the 65 lb block A and the floor is 0.40. Determine the *minimum* weight of block B for which no motion occurs.



$W_B = 9.37\, lb$

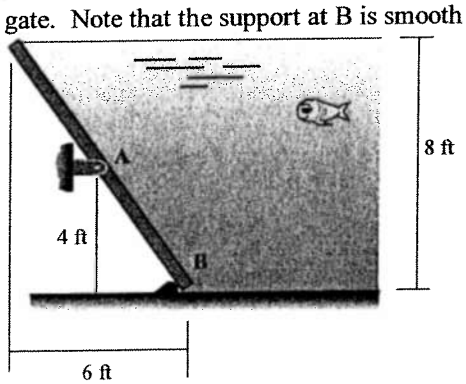
PROBLEM 6 Find the centroid $(\bar{x}, \bar{y})$ of the shaded area, where the x and y axes are located as shown. The circular hole has a radius of 1 mm. Notice that the origin of the x-y coordinate system is at the lower right.



$\bar{x} = -4\, mm$

$\bar{y} = 2.73\, mm$

PROBLEM 7 The gate has water of depth 8 ft on one side. The width of the gate (into the page) is 3 ft. The pin at A is located at the midpoint of the gate. The specific weight of the water is 62.4 lb/ft³. Find the horizontal and vertical reactions at pin A and the reaction at support B due to the water pressure on the gate. Note that the support at B is smooth and perpendicular to the gate.

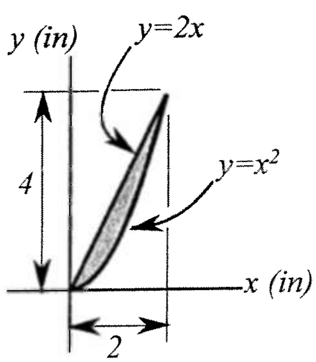


$A_x = 3994\, lb$

$A_y = 2995\, lb$

$B = 2496\, lb$

PROBLEM 8 Determine the moment of inertia of the shaded area about the x-axis by integration.



$I_x = 4.57\, in^4$