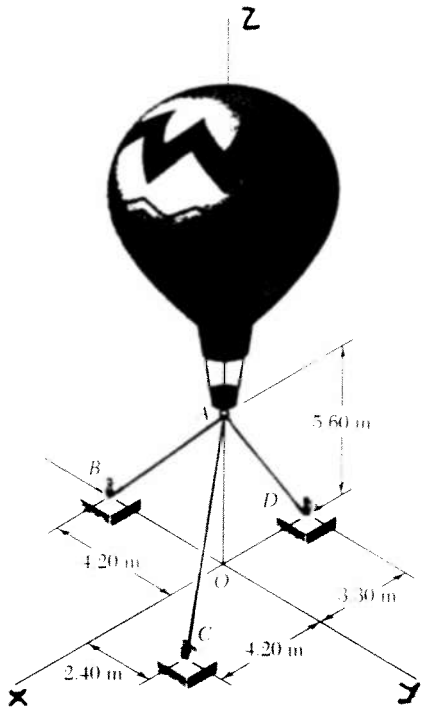
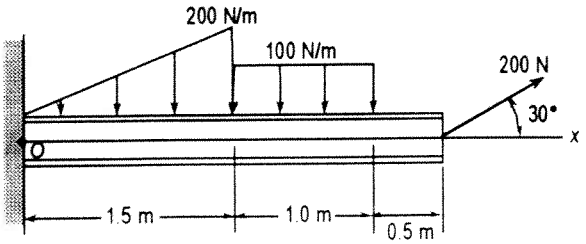
BE 50 STATICS FINAL EXAMINATION — WINTER SEMESTER 2000 — DEPT. AVG = 73.4%

1. Three cables are used to tether a balloon as shown. Knowing that the balloon exerts an 800 N vertical force at A, determine the tension in each cable.



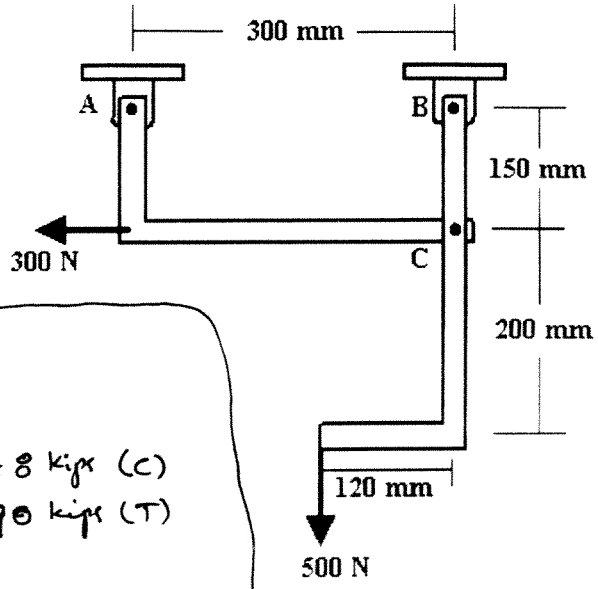

ANS: $T_{AB} = 200.9\ N$ ; $T_{AC} = 371.7\ N$ ; $T_{AD} = 415.5\ N$

2. A beam is loaded with a combination of distributed and point loads as shown. Replace the system of loads with a single equivalent force and specify its location along the x-axis measured from point O.

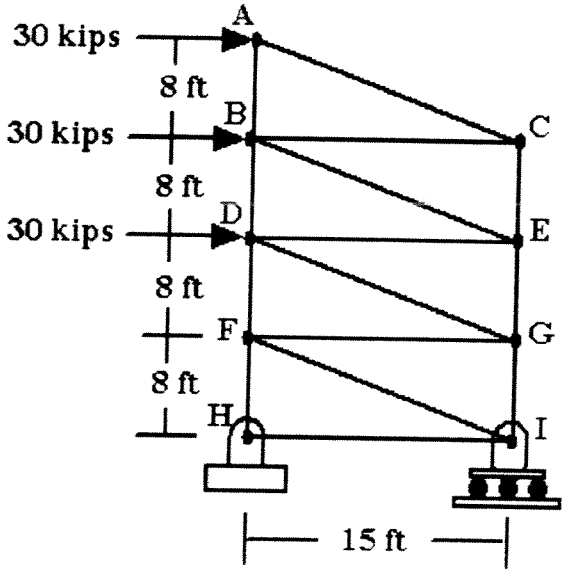



ANS: $\bar{R} = 173.2\,\hat{i} - 150\,\hat{j}\ N$ ; $X = 0.333 m$

3. Determine the horizontal and vertical components of the reactions at A and B for the simple frame loaded as shown. You may use the given sketch to create a free body diagram of the overall frame.




ANS: $A_x = 100N \leftarrow$ ; $B_x = 400N \rightarrow$
$A_y = 50N \uparrow$ ; $B_y = 450N \uparrow$




ANS:
EG = 48 kips (C)
FG = 90 kips (T)

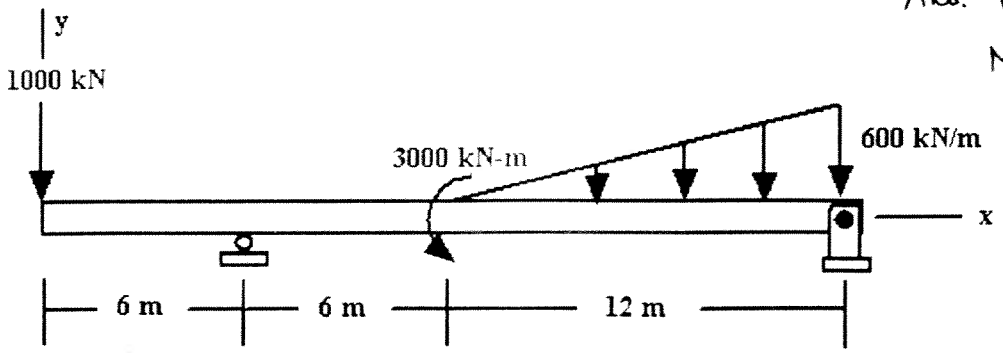
4. Determine the force in members EG and FG. Indicate if tension or compression. Proper free body diagrams are required to receive full credit.

5. Draw the complete shear force and bending moment diagrams for the beam loaded as shown. Please provide values for all pertinent points on each diagram. Write the equations for V and M as functions of x for 12 m < x < 24 m.

Ans: $V = 1300 - 25(x-12)^2$

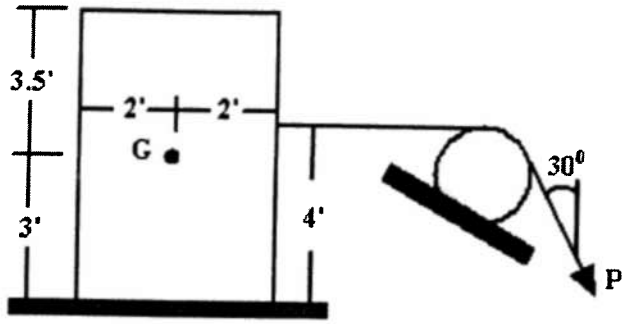
$M = 1300x - 16800 - \frac{25}{3}(x-12)^3$

$M^{+}_{max} = 5049.6$ kN·m @ x = 19.21 m




6. The crate shown has a weight of 200 lb. and a center of gravity at G. Determine the minimum force P required to cause impending motion of the crate. The coefficient of static friction is 0.4 between the crate and plane and 0.25 between the rope and fixed peg.

Ans: P = 103.9 Lb

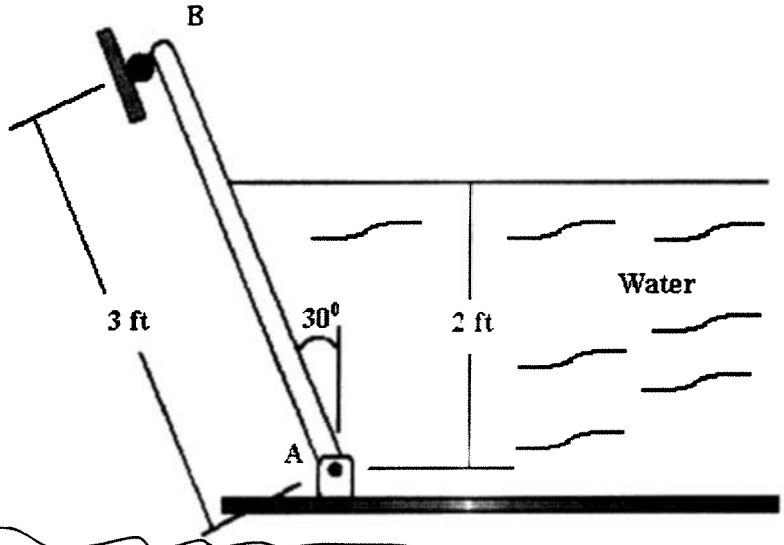



7. The homogenous gate weighs 100 lb and its width (the dimension into the page) is 3 ft. Determine the reactions at A and B. Let the specific weight of the water be 62.4 lb/ft$^3$.

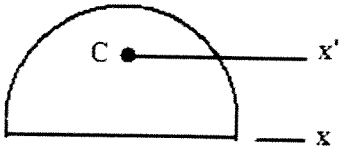
Ans: $F_B = 135.9$ Lb ↗

$A_x = 256.7$ Lb →

$A_y = 248.2$ Lb ↑

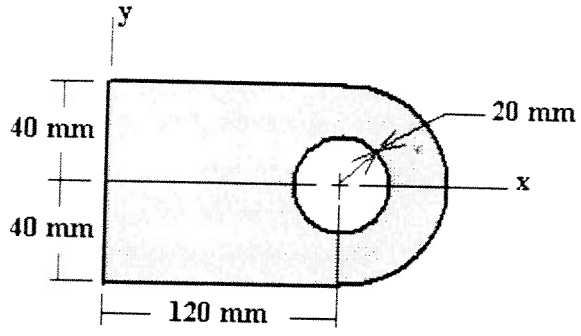



8. Determine the area moment of inertia about the y-axis for the shaded composite area. You may wish to use the formulas below.




$I_{x'} = \left(\frac{\pi}{8} - \frac{8}{9\pi}\right) r^4$

$I_x = \pi r^4 / 8$




Ans: $I_y = 75.3\,(10^6)$ mm$^4$