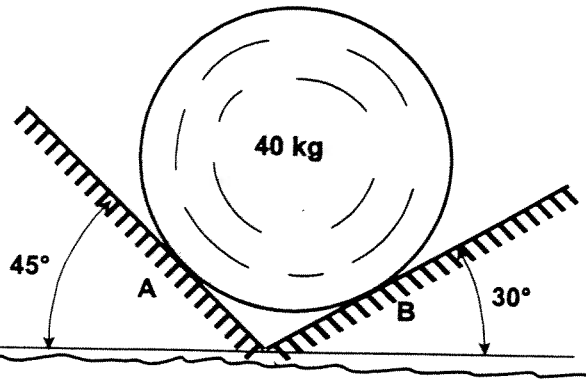
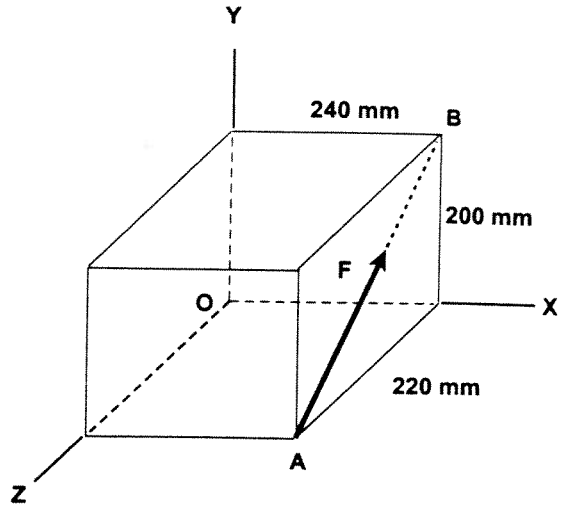
WINTER SEMESTER 1998 STATICS FINAL

1. A homogeneous sphere with a mass of 40 kg rests against two smooth (frictionless) planes that form a V-shaped trough. Determine the magnitude of the forces exerted on the sphere by the planes at contact points A and B.

ANS: $N_A = 203\,N$; $N_B = 287\,N$





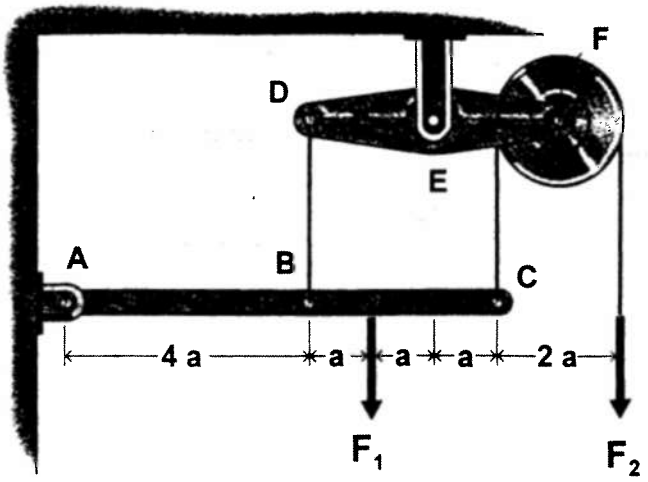
2. Force **F** acting at corner A is directed along the line AB as shown. It has a magnitude of 595 N. Replace the force **F** by a force $\mathbf{F}_o$ at O and a couple **C**. Give answers in vector notation.

ANS: $\bar{F}_o = (400\hat{j} - 440\hat{k})\,N$

$\bar{C} = (-88\hat{i} + 106\hat{j} + 96\hat{k})\,N\cdot m$

3. A force F_2 is applied to the cable that passes over the frictionless pulley at F. The system is supported by pin connections at A and E. Determine the force F_1 required for equilibrium when F_2 = 100 pounds.

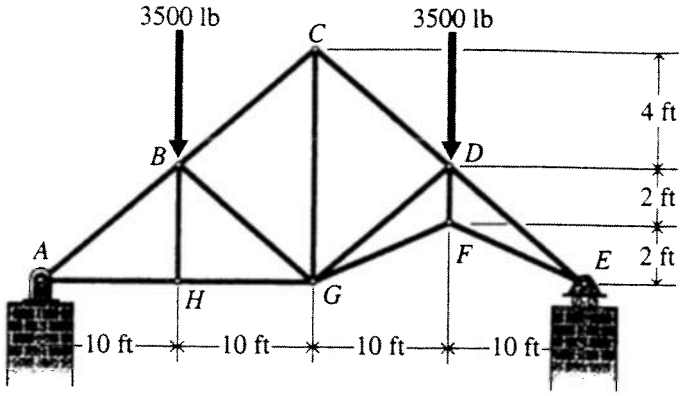
ANS: $F_1 = 300\,lb$



4. Determine the forces in members BG and BH of the pin connected truss loaded as shown. Be sure to indicate whether the members are in tension or compression.

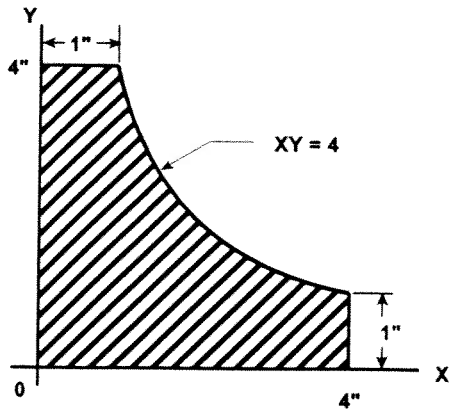
ANS: $BH = 0$

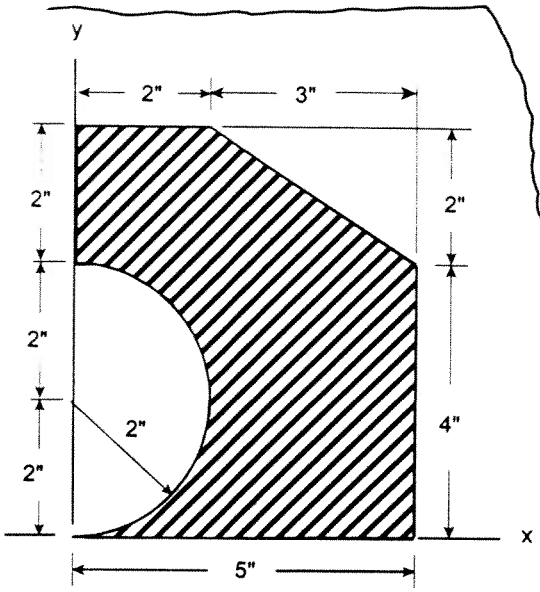
$BG = 4712\,lb\,(C)$



5. Locate the centroid of the shaded area.

ANS: $\bar{X} = \bar{Y} = 1.47''$

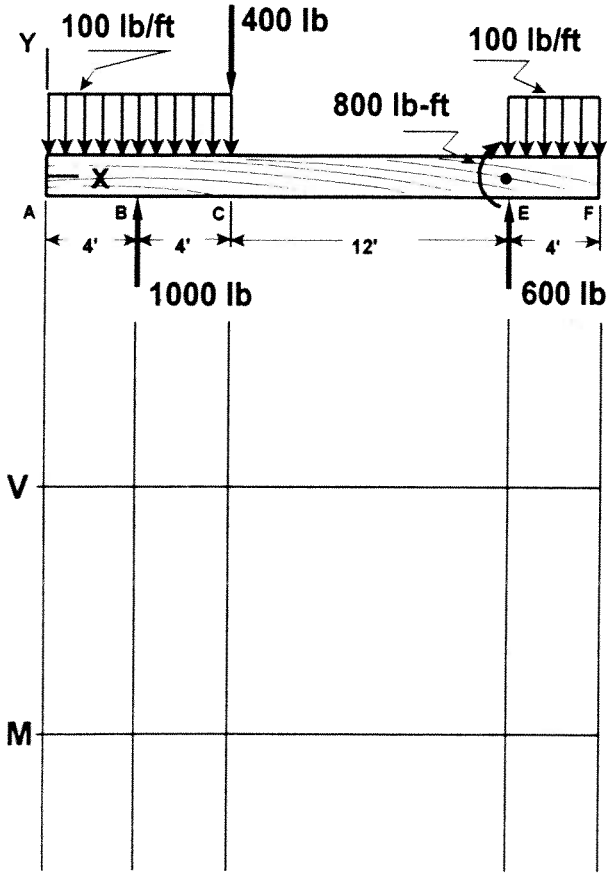




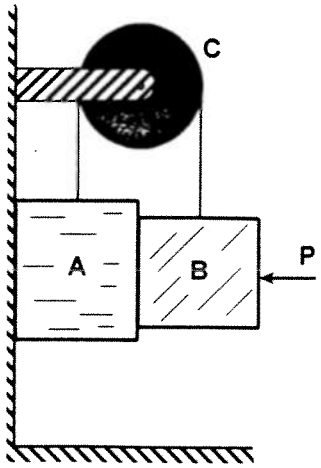
6. Determine the moment of inertia of the shaded area with respect to the x-axis (i.e. find I_x).

ANS: $I_x = 242.6\ in^4$

7. For the beam loaded as shown, draw the shear and bending moment diagrams and label all pertinent points (20 points). Also, write the equation for the bending moment in region B-C (5 points). Note that the support reactions are given.



8. Blocks A and B are connected by a cable that passes over pulley C which can rotate freely. Knowing that the coefficient of static friction at all surfaces is $\mu_s = 0.12$, determine the smallest value of the force P that will hold the blocks at rest. Blocks A and B weigh 12 lbs and 6 lbs, respectively.



ANS: P = 16.7 lb