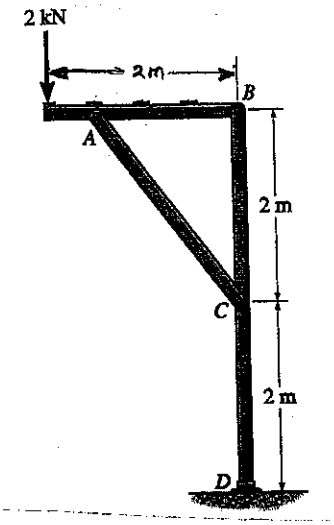
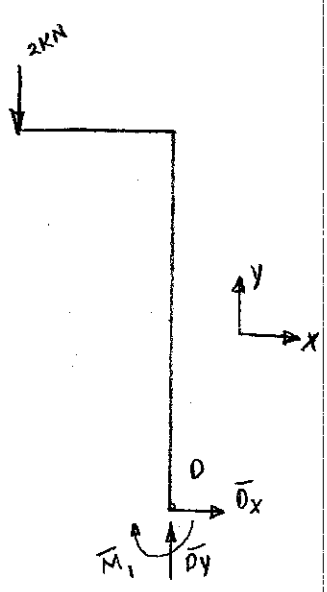
ENGR 2050
Fall 2006
Quiz #8

Determine the forces acting at pins A, B, C and the reactions at the fixed support D of the three-member frame show below.



step #1)



$\Sigma F_x = 0 = D_x$

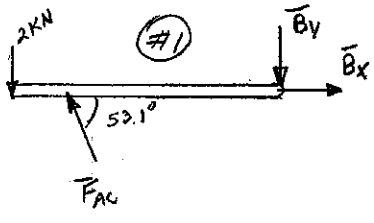
$\Sigma F_y = 0 = D_y - 2KN = 0$

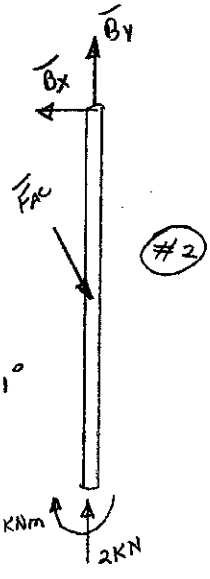
$D_y = 2KN$

$\circlearrowleft \Sigma M_D = 0 = 2KN(2m) - M_1 = 0$

$M_1 = 4KNm$

step #2 : note member AC is a 2FM.





step #3 using FBD #2

$\Sigma F_x = 0 = B_x - F_{AC}\cos 53.1°$

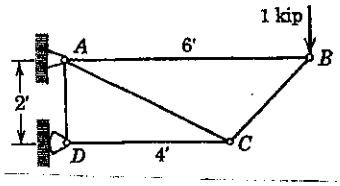
$\Sigma F_y = 0 = -2KN + F_{AC}\sin 53.1°$

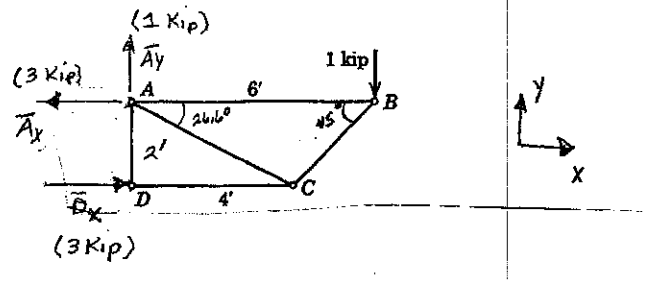
$-B_y = 0$

$\circlearrowleft \Sigma M_B = 0 = 2KN(2m) - F_{AC}\sin 53.1°(1.5m) - 4KNm$

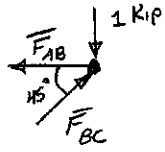
$F_{AC} = 3.33KN$, $B_x = 2.0KN$, $B_y = 0.66KN$

B. Use the method of joints to calculate the forces in each of the members of the truss shown below. Remember to state whether the member is in tension or compression. Note: I have already solved for the support reactions and they are shown on the adjacent FBD.





Pin B



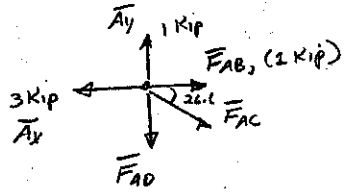
$\Sigma F_x = -\bar{F}_{AB} + F_{BC}\cos 45^\circ = 0$

$\Sigma F_y = F_{BC}\cos 45^\circ - 1\ \text{Kip}$

$F_{BC} = 1.41\ \text{Kip (C)}$

$F_{AB} = 1\ \text{Kip (T)}$

Pin A



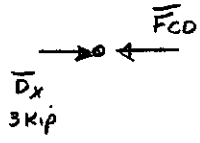
$\Sigma F_x = 0 = -3\ \text{Kip} + 1\ \text{Kip} + F_{AC}\cos 26.6^\circ = 0$

$F_{AC} = 2.23\ \text{Kip (T)}$

$\Sigma F_y = 1\ \text{Kip} - F_{AD} - F_{AC}\sin 26.6^\circ = 0$

$F_{AD} = 0$

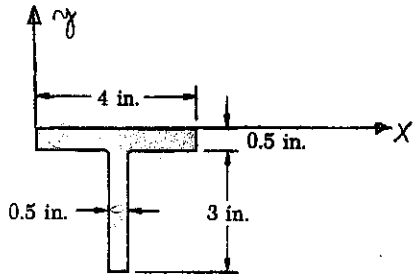
Pin D



$\Sigma F_x = 3\ \text{Kip} - F_{CD} = 0$

$F_{CD} = 3\ \text{Kip (C)}$

3. For the "T" shaped area shown below
   a. Determine the coordinates of the centroid $(\bar{x}, \bar{y})$ for this area using the coordinate system shown below.
   b. Use the formula Vol = θ r A to calculate the volume that this area sweeps out when it is rotated 90 degrees about the x-axis.



$\bar{x} = 2\text{in}$ due to symmetry

$$\bar{y} = \frac{\Sigma \tilde{y} A}{\Sigma A} = \frac{(-.25)(4)(.5) + (-2)(3)(.5)}{(4)(.5) + (3)(.5)}$$

$$\bar{y} = \frac{-3.5}{3.5} = -1.0\text{ in}$$

$Vol = \theta \bar{r} A$

$\theta = \pi/2$

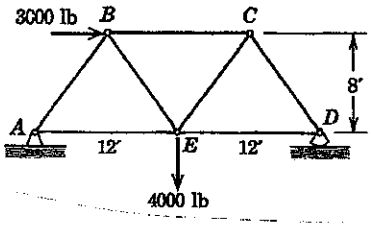
$\bar{r} = 1.0\text{in}$

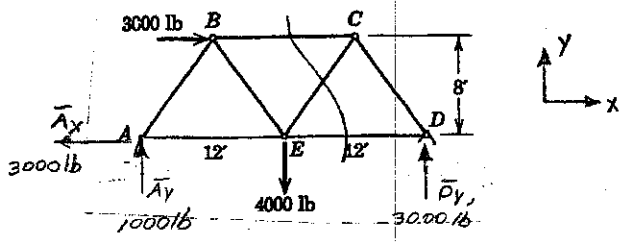
$A = 3.5\text{in}^2$

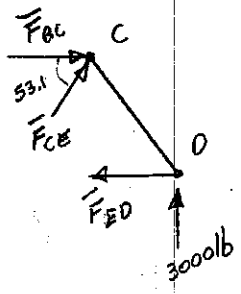
$Vol = \pi/2\,(1)(3.5)$

$Vol = 5.50\text{in}^3$

C. Use the method of sections to find the forces in members BC, CE and ED of the truss shown below. Remember to state whether the member is in tension or compression. Note: I have already solved for the support reactions and they are shown on the adjacent FBD.







$\Sigma F_x = F_{BC} + F_{CE}\cos 53.1 - F_{ED} = 0$

$\Sigma F_y = F_{CE}\sin 53.1^\circ + 3000\,lb = 0$

$F_{CE} = -3750\,lb\ (T)$

$\circlearrowleft \Sigma M_C = 0 = 3000\,lb(6ft) - F_{ED}(8ft) = 0$

$F_{ED} = 2250\,lb\ (T)$

$F_{BC} = 4500\,lb\ (C)$