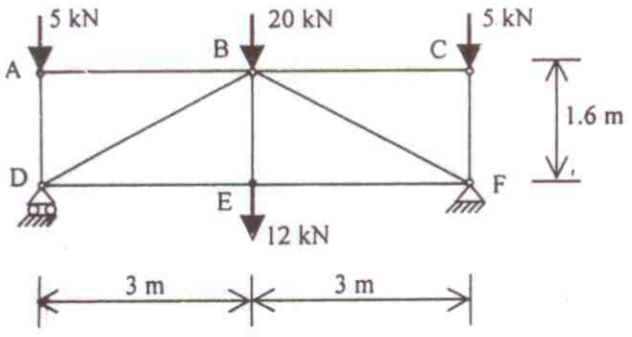
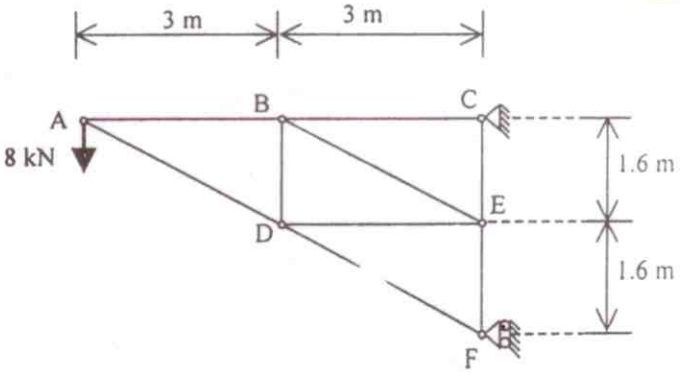
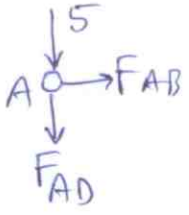
P.31

P.31. Using the method of joints, determine the forces in the member of the trusses shown. (3)

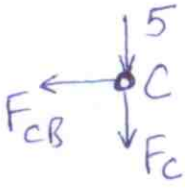




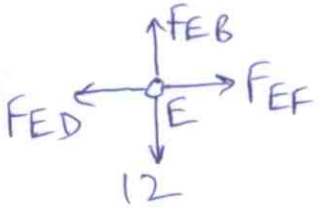
(a)



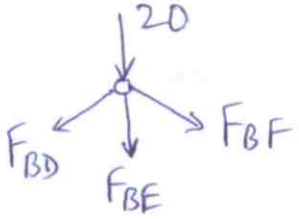
$F_{AB} = 0$, $F_{AD} = -5\,(C)$



$F_{CB} = 0$, $F_{CF} = -5\,(C)$

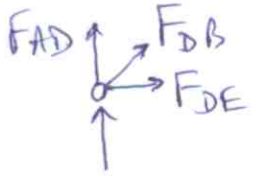


$F_{EB} = 12\,(T)$, $F_{ED} = F_{EF}$



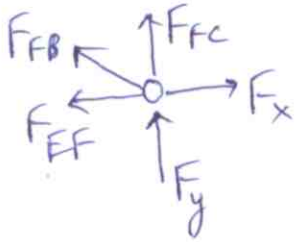
$F_{BD} = F_{BF}$

$2F_{BD}\left(\frac{1.6}{3.4}\right) + 20 + F_{BE} = 0 \rightarrow F_{BD} = -34\,(C)$
$= F_{BF}$



$F_{DE} + F_{DB}\left(\frac{3}{3.4}\right) = 0 \rightarrow F_{DE} = 30\,(T)$
$= F_{EF}$

$= -F_{AD} - F_{DB}\left(\frac{1.6}{3.4}\right) = 21$



$F_x = F_{EF} + F_{FB}\left(\frac{3}{3.4}\right) = 0$

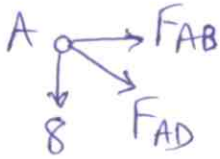
$F_y = -F_{FC} - F_{FB}\left(\frac{1.6}{3.4}\right) = 21$

} same result as external equilibrium

(b) $C_y = 8$, $8(6) + F_x(3.2) = 0 \rightarrow F_x = -15 \rightarrow C_x = 15$

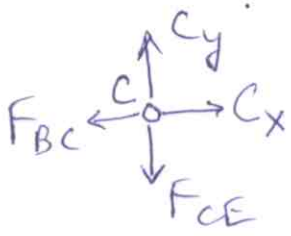
A: $F_{AD}\left(\frac{1.6}{3.4}\right) + 8 = 0 \rightarrow F_{AD} = -17\,(C)$

$F_{AB} = -F_{AD}\left(\frac{3}{3.4}\right) = 15\,(T)$



C: $F_{BC} = C_x = 15\,(T)$

$F_{CE} = C_y = 8\,(T)$



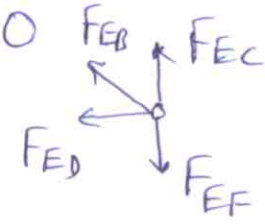
not required.

F: $F_{DF}\left(\frac{3}{3.4}\right) = F_x \rightarrow F_{DF} = -17\,(C)$

$F_{EF} = -F_{DF}\left(\frac{1.6}{3.4}\right) = 8\,(T)$

E: $F_{BE}\left(\frac{1.6}{3.4}\right) = -F_{CE} + F_{EF} \rightarrow F_{BE} = 0$

$\Rightarrow F_{DE} = 0$



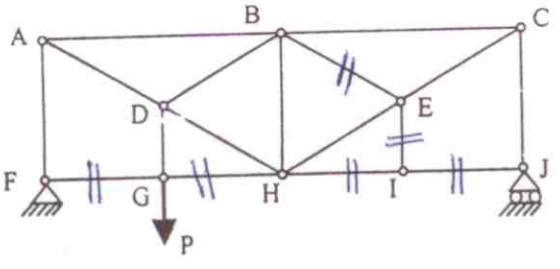
B: $\Rightarrow F_{BD} = 0$

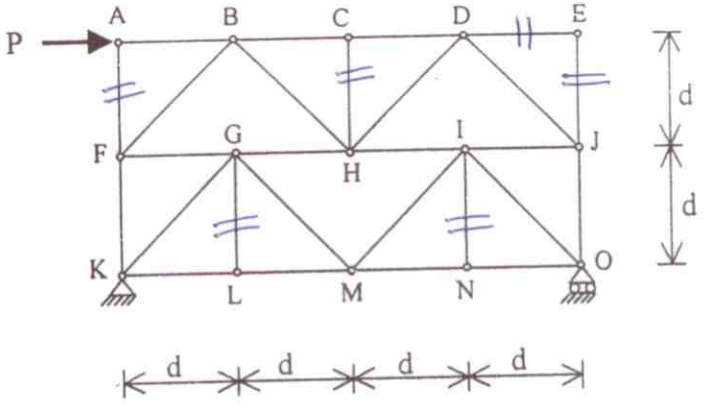
D: (Check that $F_{AD} = F_{DF}$).

→ can see from here itself that $\because F_{AB} = F_{BC}$,

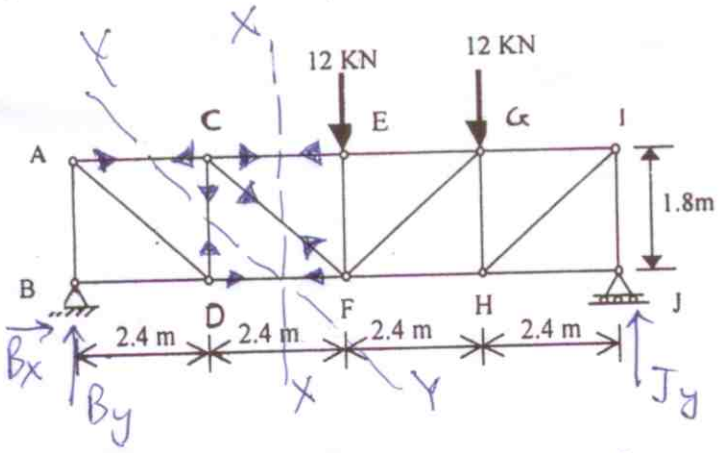
$\Rightarrow F_{BE} = 0,\ F_{BD} = 0,\ F_{DE} = 0,\ F_{EF} = F_{CE},\ F_{AD} = F_{DF}$

P.32. Determine the zero-force members in the trusses shown for the given loading.

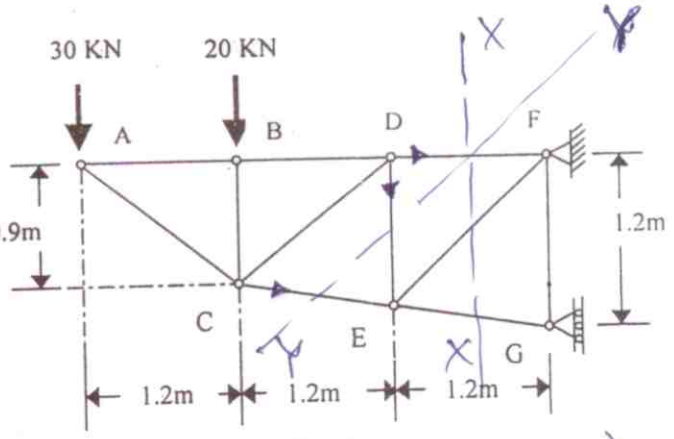




P.33. Determine the forces in members CD and DE of the truss shown



P.34. Determine the forces in members DF and DE of the truss shown.



(P33) $B_y = \dfrac{12(2.4)+12(4.8)}{9.6} = 9$ (from $\Sigma M_J = 0$)

$B_x = 0$, $J_y = 24 - 9 = 15$

For cut XX, & LH FBD, $\Sigma M_C = 0 \Rightarrow B_y(2.4) = F_{DF}(1.8)$

$\Rightarrow F_{DF} = 12\ (T)$

For cut YY, & LHFBD, $\Sigma M_A = 0$ {or $\Sigma F_y = 0$} $\Rightarrow F_{DF}(1.8) + F_{CD}(2.4) = 0$

$\Rightarrow F_{CD} = -9\ (C)$

For cut XX, & RHFBD, $\Sigma M_F = 0 \Rightarrow F_{CE}(1.8) - 12(2.4) + J_y(4.8) = 0$

$\Rightarrow F_{CE} = -24\ (C)$

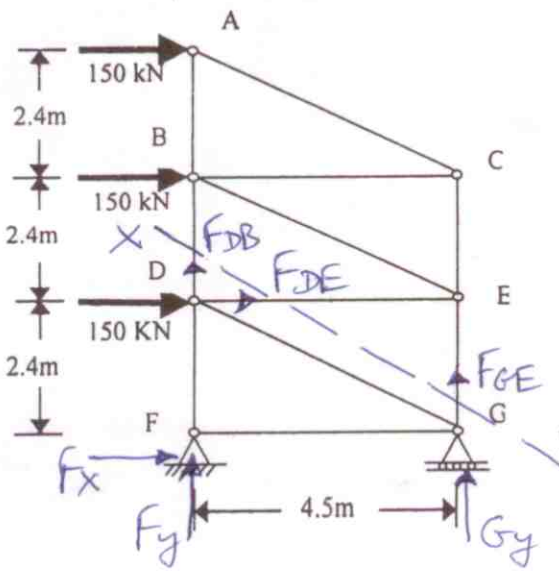
P(34) Cut XX, LHFBD, $\Sigma M_E = 0$

$\Rightarrow 30(2.4) + 20(1.2) - F_{DF}(1.05) \Rightarrow 91.429 = F_{DF}$

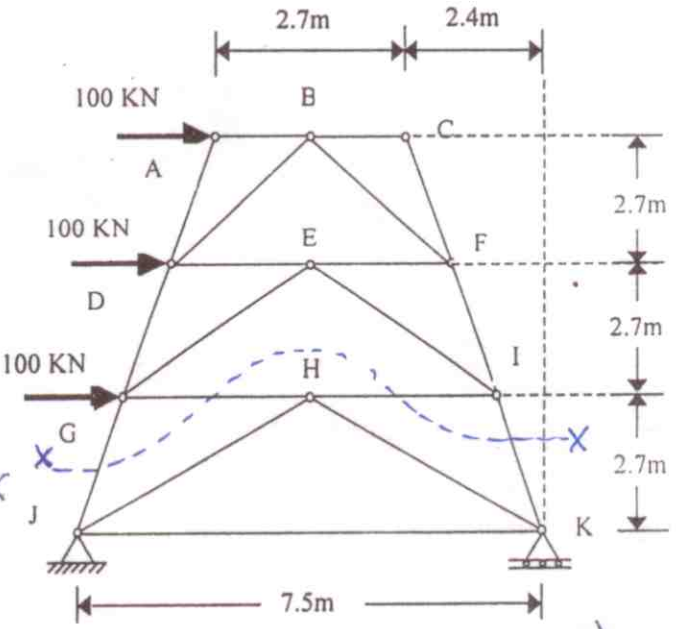
Cut YY, LHFBD, $\Sigma M_C = 0$

$\Rightarrow F_{DF}(0.9) + F_{DE}(1.2) = 0 \Rightarrow F_{DE} = -68.57$

P.35. Determine the forces in members *BD* and *DE* of the truss shown.



P.36. Determine the forces in members *GJ* and *IK* of the truss shown.



(P35) $F_x = -450$, $G_y = -F_y = \dfrac{150(2.4+4.8+7.2)}{4.5}$

$= 480$

Lower FBD, Cut XX:

$\Sigma F_x = 0 \Rightarrow F_x + F_{DE} = 0 \Rightarrow F_{DE} = 450 - 150 = 300$ (+150)

$\Sigma M_G = 0 \Rightarrow F_{DE}(2.4) + F_{DB}(4.5) + F_y(4.5) = 0$

$\Rightarrow F_{DB} = 240$

(P36) $J_x = -300$, $K_y = -J_y = 100(2.7+5.4+8.1)/7.5$

$= 1620/7.5 = 216.$

Section xx, lower FBD:

$$\Sigma M_G = 0 \Rightarrow F_{IK}\left[\frac{0.8}{\sqrt{0.8^2+2.7^2}} * 2.7 - \frac{2.7}{\sqrt{0.8^2+2.7^2}} * 6.7\right]$$

$$+ J_y(0.8) - J_x(2.7) - K_y(6.7) = 0$$

$\Rightarrow F_{IK} = -143.19\ kN = 143.19\ kN\ (C)$ ◄

$$\Sigma M_I = 0 \Rightarrow F_{GJ}\left[\frac{2.7}{\sqrt{0.8^2+2.7^2}} * 6.7 - \frac{0.8}{\sqrt{0.8^2+2.7^2}} * 2.7\right] + J_y(6.7)$$

$$- J_x(2.7) - K_y(0.8) = 0$$

$\Rightarrow F_{GJ} = 143.19\ (T)$ ◄