

$\theta = \tan^{-1}\left(\frac{27}{36}\right)$
 $= 36.87^\circ$
 $\alpha = \tan^{-1}\left(\frac{12}{9}\right) = 53.13^\circ$

Section 1-1':
 $F_{FB} \sin \theta = 6$
 $\Rightarrow F_{FB} = \frac{6}{\sin(36.87^\circ)}$
 $F_{FB} = 10k$
 $F_{GB} = -F_{FB} \cos \theta$
 $= -10\left(\frac{4}{5}\right)$
 $F_{GB} = -8k$

$\sum F_{vertical} = 0$
 $\Rightarrow V_C + 6 + 12 + 12 + 6 = 0$
 $\Rightarrow V_C = -36k$

$\sum F_{horiz.} = 0$
 $\Rightarrow R_C + R_A = 0$ (see *)

Joint G:
 $F_{FG} = 0$
 $\Rightarrow F_{EG} = F_{GB} = -8k$
 $F_{EG} = 8k \quad 8k = F_{GB}$

Section 2-2':
 $-30 + F_{AC} + F_{CB} \sin \theta = 0$

Joint F:
 $\Rightarrow R_A(27) = (12)(12) + (12)(24) + 6(36)$
 $\Rightarrow R_A = 24k$
 $\Rightarrow R_C = -24k$
 $\Rightarrow 12 + F_{FB} \sin \theta + F_{FE} \cos(53.13^\circ) = F_{FD} \cos \theta + F_{FF} \cos \theta = 0$

$$\begin{aligned} \sum F_{\text{vertical}} &= 0 \\ \Rightarrow V_C + 6 + 12 + 12 + 6 &= 0 \\ \Rightarrow V_C &= -36R \end{aligned}$$

$$\begin{aligned} \sum F_{\text{HORIZ.}} &= 0 \\ \Rightarrow R_C + R_A &= 0 \quad \text{See * } \end{aligned}$$

Joint G:

$$F_{G4} = 0$$

$$\Rightarrow F_{G4} = F_{4B} = -8R$$

$$F_{E4} = 8R \quad \leftarrow \quad \rightarrow \quad 8R = F_{4B}$$

Section 2-21:

$$-30 + F_{AC} + F_{CD} \sin \theta = 0$$

$$\text{and } R_C + F_{CD} \cos \theta = 0$$

$$F_{CD} = \frac{24}{.8} = 30R$$

$$\Rightarrow F_{AC} = 12R$$

Joint A:

$$R_A + F_{AD} (0.554) + F_{AE} = 0$$

$$F_{AC} + F_{AD} (0.832) = 0$$

$$\Rightarrow F_{AD} = \frac{-12}{.832} = -14.42R$$

$$\Rightarrow F_{AE} = -31.96R$$

$$\Rightarrow F_{FB} = \frac{6}{\sin(36.87^\circ)}$$

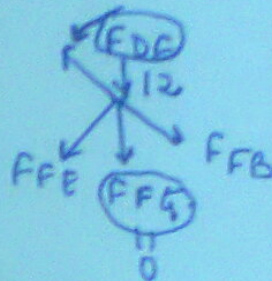
$$F_{FB} = 10R$$

$$\begin{aligned} F_{4B} &= -F_{FB} \cos \theta \\ &= -10 \left(\frac{4}{5} \right) \end{aligned}$$

$$F_{4B} = -8R$$

$$\sum M_C = 0$$

Joint F:



$$\begin{aligned} \Rightarrow R_A (27) &= (12)(12) \\ &+ (12)(24) \\ &+ 6(36) \end{aligned}$$

$$\Rightarrow R_A = 24R$$

$$\Rightarrow R_C = -24R$$

$$\begin{aligned} \Rightarrow 12 + F_{FB} \sin \theta \\ + F_{FE} \cos(53.13^\circ) &= F_{DF} \sin \theta \end{aligned}$$

$$\begin{aligned} \Rightarrow 12 + 6 + .6 F_{FE} &= F_{DF} (0.6) \end{aligned}$$

$$\Rightarrow F_{FE} = F_{DF} = 30 \quad \text{--- (1)}$$

$$\begin{aligned} F_{DE} \\ + F_{FE} \cos \theta &= 0 \\ \Rightarrow F_{DE} &= 6R \end{aligned}$$

Also:

$$F_{FB} \cos \theta = F_{DF} \cos \theta + F_{FE} \sin(3.13^\circ)$$

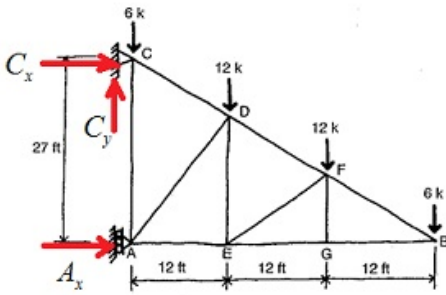
$$\Rightarrow 8 = F_{DF} (.8) + (.8) F_{FE}$$

$$\Rightarrow F_{DF} + F_{FE} = 10 \quad \text{--- (2)}$$

$$\text{(1) \& (2) } \Rightarrow F_{DF} = 20R$$

$$F_{FE} = -10R$$

Draw the free body diagram of the truss.



Take moment about joint C.

$$\sum M_C = 0$$

$$A_x \times 27 - 12 \times 12 - 12 \times 24 - 6 \times 36 = 0$$

$$A_x = 24 \text{ k}$$

Consider the equilibrium of forces along the horizontal.

$$\sum F_x = 0$$

$$C_x + A_x = 0$$

$$C_x = -24 \text{ k}$$

Consider the equilibrium of forces along the vertical.

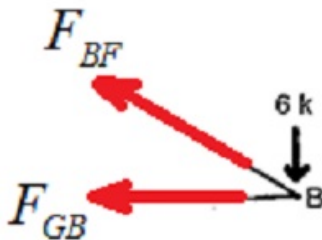
$$\sum F_y = 0$$

$$C_y - 6 - 12 - 12 - 6 = 0$$

$$C_y - 6 - 12 - 12 - 6 = 0$$

$$C_y = 36 \text{ k}$$

Consider the joint B.



Calculate the angle between the members BF and GB.

$$\tan \theta = \frac{27}{36}$$

$$\theta = 36.87$$

Consider the equilibrium of forces along the vertical.

$$\sum F_y = 0$$

$$6 - F_{BF} \sin \theta = 0$$

$$6 - F_{BF} \sin 36.87^\circ = 0$$

$$F_{BF} = 10 \text{ k (Tension)}$$

Consider the equilibrium of forces along the horizontal.

$$\sum F_x = 0$$

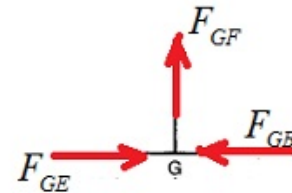
$$F_{GB} + F_{BF} \cos \theta = 0$$

$$F_{GB} + 10 \times \cos 36.87^\circ = 0$$

$$F_{GB} = -8 \text{ k}$$

$$F_{GB} = 8 \text{ k (Compression)}$$

Consider the joint G.



Consider the equilibrium of forces along the vertical.

$$\sum F_y = 0$$

$$F_{GF} = 0 \text{ (Zero force member)}$$

Consider the equilibrium of forces along the horizontal.

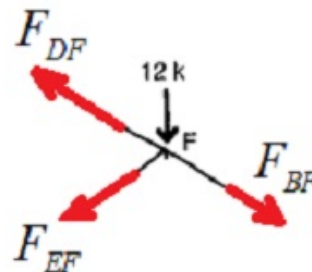
$$\sum F_x = 0$$

$$F_{GB} - F_{GE} = 0$$

$$F_{GE} = F_{GB}$$

$$F_{GE} = 8 \text{ k (Compression)}$$

Consider the joint F.



Consider the equilibrium of forces along the vertical.

$$\sum F_y = 0$$

$$12 + F_{EF} \sin \theta + F_{BF} \sin \theta - F_{DF} \sin \theta = 0$$

$$12 + (F_{EF} + F_{BF} - F_{DF}) \sin \theta = 0$$

$$12 + (F_{EF} + 10 - F_{DF}) \sin 36.87^\circ = 0$$

$$F_{EF} + 10 - F_{DF} = -20$$

$$F_{EF} - F_{DF} = -30 \quad \dots (1)$$

Consider the equilibrium of forces along the horizontal.

$$\sum F_x = 0$$

$$F_{EF} \cos \theta + F_{DF} \cos \theta - F_{BF} \cos \theta = 0$$

$$(F_{EF} + F_{DF} - F_{BF}) \cos \theta = 0$$

$$F_{EF} + F_{DF} - F_{BF} = 0$$

$$F_{EF} + F_{DF} - 10 = 0$$

$$F_{EF} + F_{DF} = 10 \quad \dots (2)$$

Add equation (1) and (2)

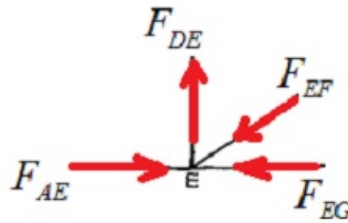
$$(F_{EF} - F_{DF}) + (F_{EF} + F_{DF}) = -30 + 10$$

$$2F_{EF} = -20$$

$$F_{EF} = -10 \text{ k}$$

$$F_{EF} = 10 \text{ k (Compression)}$$

Consider the joint E .



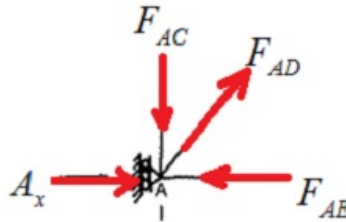
Consider the equilibrium of forces along the vertical.

$$\begin{aligned}\sum F_y &= 0 \\ F_{DE} - F_{EF} \sin \theta &= 0 \\ F_{DE} - 10 \sin 36.87^\circ &= 0 \\ F_{DE} &= 6 \text{ k (Tension)}\end{aligned}$$

Consider the equilibrium of forces along the horizontal.

$$\begin{aligned}\sum F_x &= 0 \\ F_{AE} - F_{EG} - F_{EF} \cos \theta &= 0 \\ F_{AE} - 8 - 10 \times \cos 36.87^\circ &= 0 \\ F_{AE} &= 16 \text{ k (Compression)}\end{aligned}$$

Consider the joint A .



Consider the equilibrium of forces along the horizontal.

$$\begin{aligned}\sum F_x &= 0 \\ A_x + F_{AD} \cos \theta - F_{AE} &= 0 \\ 24 + F_{AD} \cos 36.87^\circ - 16 &= 0 \\ F_{AD} &= -10 \\ F_{AD} &= 10 \text{ k (Compression)}\end{aligned}$$

Consider the equilibrium of forces along the vertical.

$$\begin{aligned}\sum F_y &= 0 \\ F_{AC} - F_{AD} \sin \theta &= 0 \\ F_{AC} - (-10) \sin 36.87^\circ &= 0 \\ F_{AC} &= -6 \text{ k} \\ F_{AC} &= 6 \text{ k (Tension)}\end{aligned}$$

Consider the joint C .

