

EGR 180

6/29/10

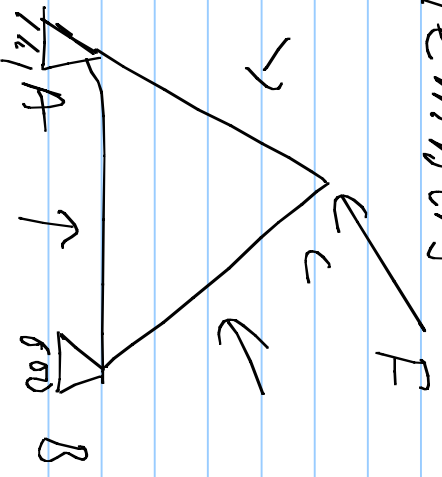
Trusses, Frames & Machines

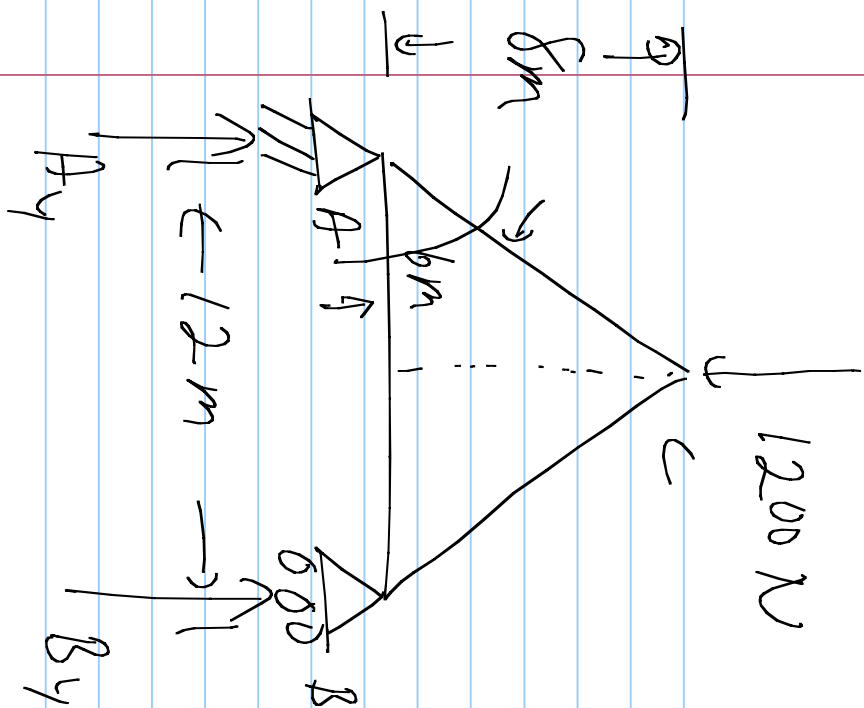


Two force systems

Members

Force members



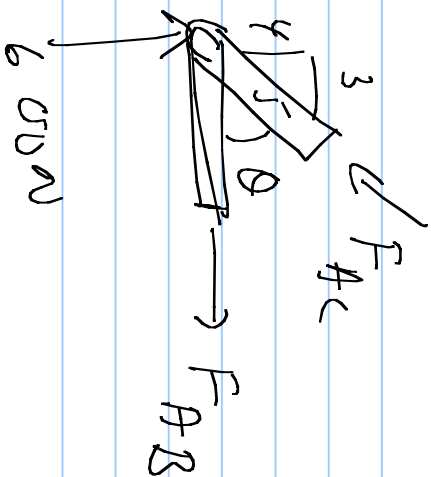


$$\sum M_A = 6 \cdot 1200 + 12B = 0$$

$$B = 600 \text{ N}$$

$$\sum F_y = A_y + 600 - 1200 = 0$$

$$A_y = 600 \text{ N}$$

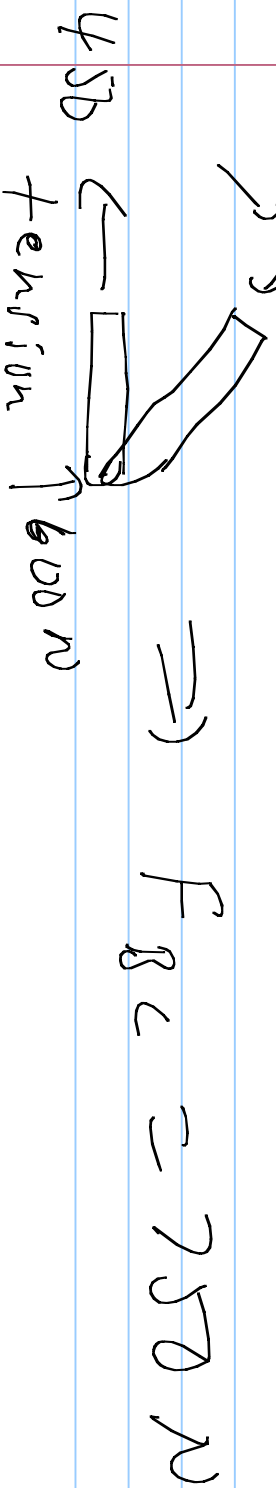


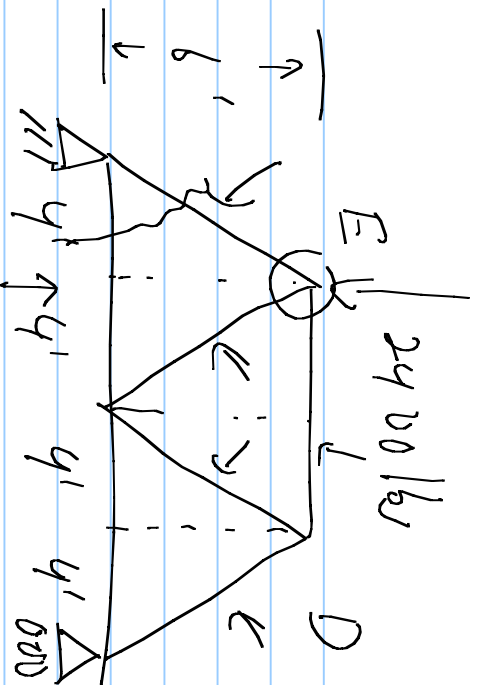
$$\sum F_y = 600 - F_{AC} \sin \theta = 0 \quad \sin \theta = .8$$

$$F_{AC} = \frac{600}{.8} = 750 \text{ N} \quad \cos \theta = .6$$

$$\sum F_x = -F_{AC} \cos \theta + F_{AB} = 0$$

Compression  $F_{BC}$   $F_{AB} = F_{AC} \cos \theta = 750 (.6) = 450 \text{ N}$



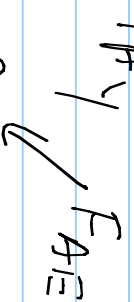


$$\sum M_A = 16 C_y - 4 \cdot 2400 = 0$$

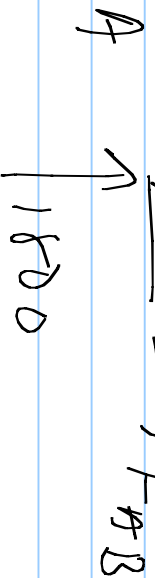
$$C_y = 600 \text{ lbs}$$

$$\sum F_y = A_y + 600 - 2400 = 0$$

$$A_y = 1800 \text{ lbs}$$



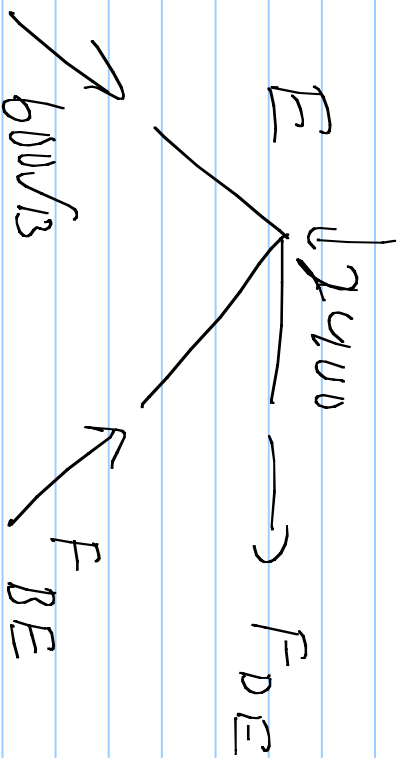
$$\sum F_y = 1800 - F_{AE} \frac{3}{4} = 0$$



$$F_{AE} = 600\sqrt{13} \text{ lbs} = 2163 \text{ lbs}$$

$$\sum F_x = F_{AB} - F_{AE} \frac{2}{\sqrt{13}} = 0$$

$$F_{AB} = 600\sqrt{13} = \frac{2}{\sqrt{13}} = 1200 \text{ lbs}$$

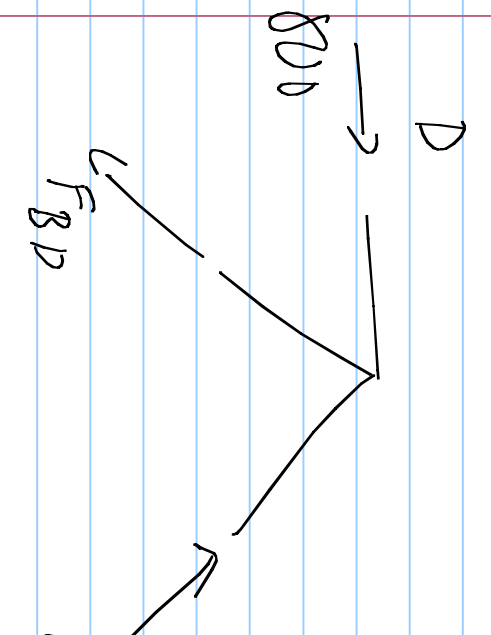


$$\sum F_y = 600\sqrt{3} \cdot \frac{3}{\sqrt{3}} + F_{BE} \frac{3}{\sqrt{3}} - 2400 = 0$$

$$\frac{3}{\sqrt{3}} F_{BE} = 600 \Rightarrow F_{BE} = 200\sqrt{3} \text{ lbs}$$

$$\sum F_x = 600\sqrt{3} \cdot \frac{2}{\sqrt{3}} - 200\sqrt{3} \cdot \frac{2}{\sqrt{3}} + F_{DE} = 0$$

$$F_{DE} = -800 \text{ lbs}$$



$$\sum F_y = F_{CD} \frac{2}{\sqrt{3}} - F_{BD} \frac{2}{\sqrt{3}} = 0$$

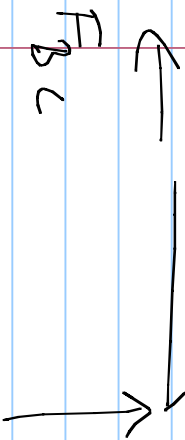
$$F_{CD} = F_{BD}$$

$$\sum F_x = 800 - F_{BD} \frac{2}{\sqrt{3}} - F_{CD} \frac{2}{\sqrt{3}} = 0$$

$$\frac{4}{\sqrt{3}} F_{BD} = 800$$

$$F_{BD} = F_{CD} = 200\sqrt{3}$$

$\searrow 200\sqrt{13}$

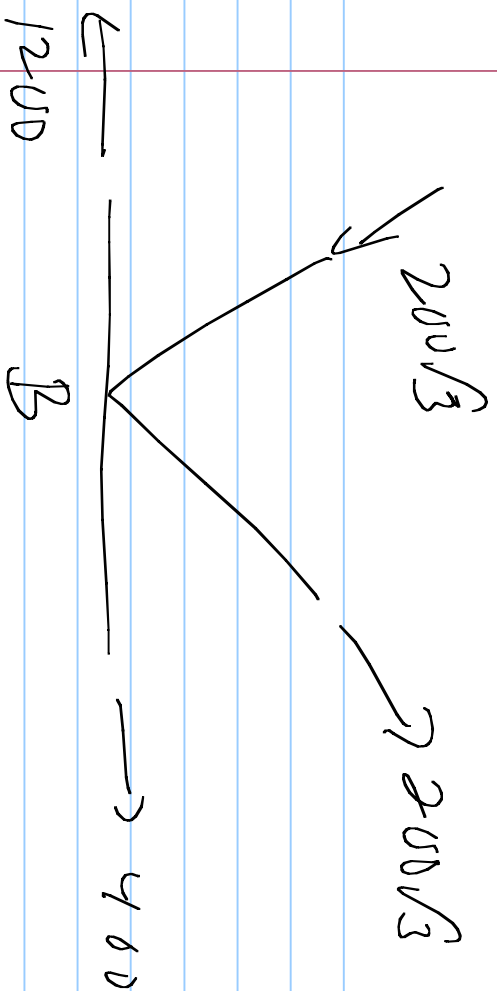


$$\sum F_y = 600 - 200\sqrt{13} \cdot \frac{3}{\sqrt{13}} = 0$$

$$\sum F_x = -F_{BC} + 200\sqrt{13} \cdot \frac{2}{\sqrt{13}} = 0$$

600

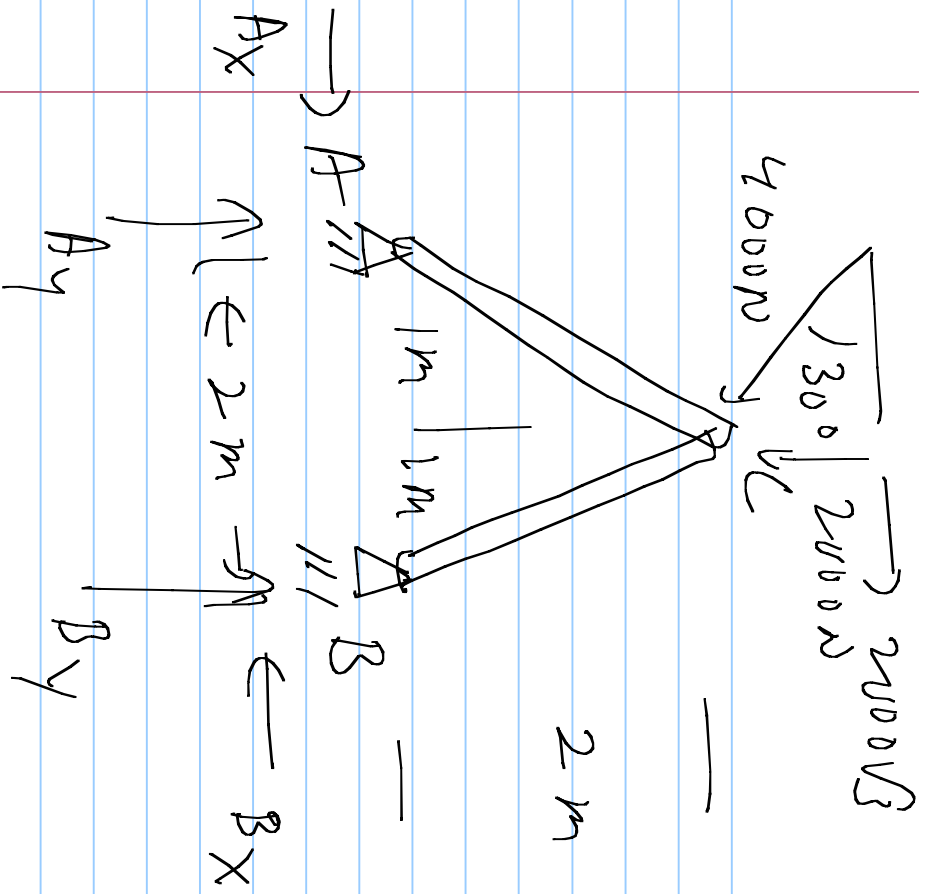
$$F_{BC} = 400 \text{ lbs}$$



$$\sum F_y = -200\sqrt{3} \cdot \frac{3}{\sqrt{3}}$$

$$+ 200\sqrt{3} \cdot \frac{3}{\sqrt{3}} = 0$$

$$\begin{aligned} \sum F_x &= -1200 + 400 + 200\sqrt{3} \cdot \frac{2}{\sqrt{3}} + 200\sqrt{3} \cdot \frac{2}{\sqrt{3}} \\ &= -800 + 400 + 400 = 0 \checkmark \end{aligned}$$



$$\sum M_A = 2B_y - 1 \cdot 2000 - 2(2000\sqrt{3}) = 0$$

$$B_y = 1600 + 2000\sqrt{3}$$

$$\sum F_y = A_y + 1600 + 2000\sqrt{3}$$

$$- 2000 = 0$$

$$A_y = 1000 - 2000\sqrt{3}$$

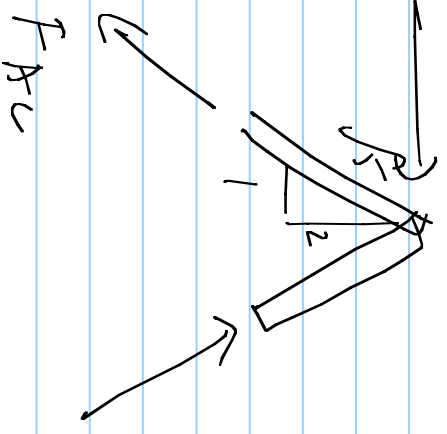
$$\sum F_x = A_x - B_x + 2000\sqrt{3} = 0$$

$$A_x = B_x - 2000\sqrt{3}$$

$$2000\sqrt{3} \quad \downarrow \quad 2000$$

$$\sum F_y = F_{BC} \sin \theta - F_{AC} \sin \theta - 2000 = 0$$

$$\frac{1}{2} F_{BC} - \frac{1}{2} F_{AC} = 2000$$



$$\sum F_X = 2500 \sqrt{3} - F_{Ac} \frac{1}{5} - F_{Bc} \frac{1}{5} = 0$$

$$F_{Ac} + F_{Bc} = 2500 \sqrt{15}$$

$$F_{Bc} - F_{Ac} = 1000 \sqrt{5}$$

$$2F_{Bc} = 2000 \sqrt{15} + 1000 \sqrt{5}$$

$$F_{Bc} = 1000 \sqrt{15} + 500 \sqrt{5}$$

$$F_{Ac} = 1000 \sqrt{15} - 500 \sqrt{5}$$

$$1500\sqrt{5} - 500\sqrt{5}$$

$$\sum_{i=1}^2 F_x = -A_x + (1500\sqrt{5} - 500\sqrt{5}) \frac{1}{\sqrt{5} = 0}$$

$$A_x = \frac{2000\sqrt{5} - 4000}{\sqrt{5} = 0}$$

$$B_x = 2000\sqrt{3} - A_x = 1000\sqrt{3} + 500$$