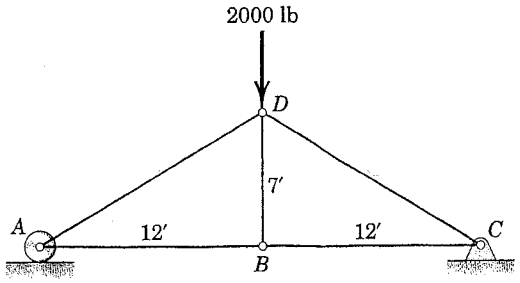
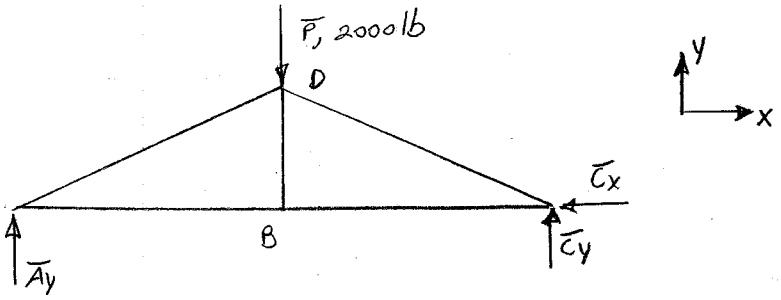
10A Determine the force in each member of the loaded truss shown below. Make sure to indicate whether the member is in tension or compression.




$\Sigma \bar{F}_x = (-C_x)\bar{i} = 0 \Rightarrow C_x = 0$

$\Sigma \bar{F}_y = (A_y + C_y - 2000)\bar{j} = 0$

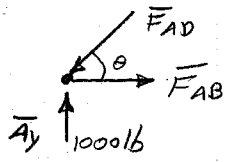
$\therefore A_y + C_y = 2000\,lb$

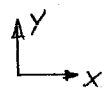
$\Sigma \bar{M}_C = 0 = (-A_y(24) + 2000(12))\bar{k} = 0$

$\therefore A_y = 1000\,lb$

$\therefore C_y = 1000\,lb$

start with pin A




$\tan\theta = \frac{7}{12} \Rightarrow \theta = 30.3^\circ$

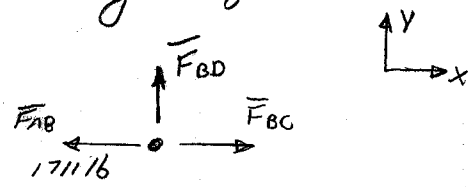
$\Sigma \bar{F}_x = (-F_{AD}\cos 30.3^\circ + F_{AB})\bar{i} = 0$

$\Sigma \bar{F}_y = 0 = (1000\,lb - F_{AD}\sin 30.3^\circ)\bar{j}$

$\therefore F_{AD} = 1982\,lb\,(C)$

$F_{AB} = 1711\,lb\,(T)$

looking at pin B



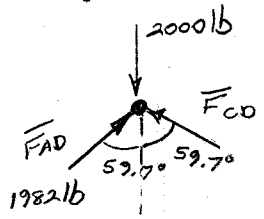

$$\Sigma \bar{F}_x = (-1711\text{lb} + F_{BC})\,\bar{i} = 0$$

$$\therefore F_{BC} = 1711\text{lb (T)}$$

$$\Sigma \bar{F}_y = 0 = (F_{BD}(\bar{j})) = 0$$

$$\therefore F_{BD} = 0$$

looking at pin D




$$\Sigma \bar{F}_x = 0 = (1982 \sin 59.7° - F_{CD} \sin 59.7°)\,\bar{i}$$

$$\therefore F_{CD} = 1982\text{lb (C)}$$

$$\therefore \bar{A}_y = 1000\text{lb}\,\bar{j}$$

$$\bar{C}_y = 1000\text{lb}\,\bar{j}$$

$$F_{AD} = 1982\text{lb (C)}$$

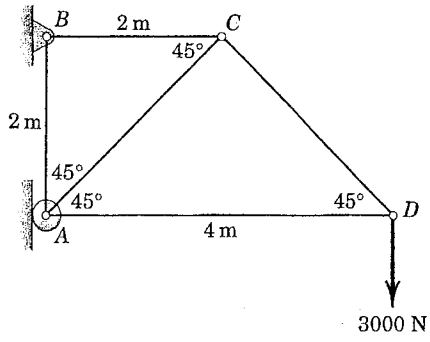
$$F_{AB} = 1711\text{lb (T)}$$

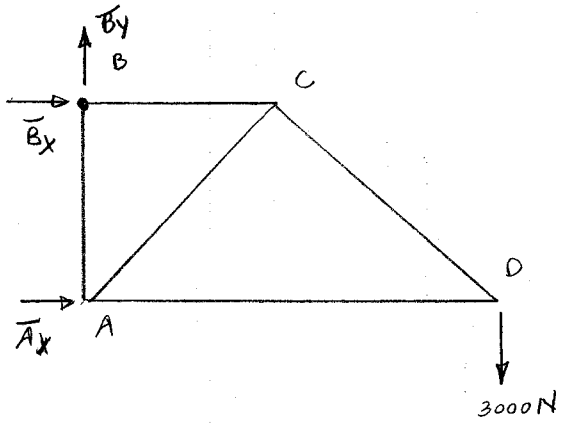
$$F_{BC} = 1711\text{lb (T)}$$

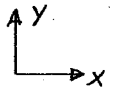
$$F_{BD} = 0$$

$$F_{CD} = 1982\text{lb (C)}$$

10B Determine the force in each member of the loaded truss shown below. Make sure to indicate whether the member is in tension or compression.




$\Sigma \bar{F}_x = (B_x + A_x)\bar{i} = 0$

$B_x = -A_x$

$\Sigma \bar{F}_y = (B_y - 3000N)\bar{j}$

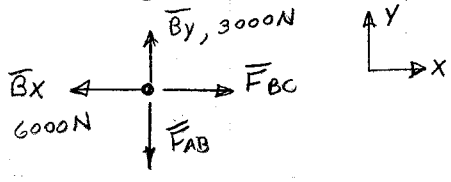
$B_y = 3000N$

$\Sigma \bar{M}_B = 0 = (A_x(2m) - 3000N(4m))\bar{k}$

$\therefore A_x = 6000N$

$B_x = -6000N$
(wrong direction)

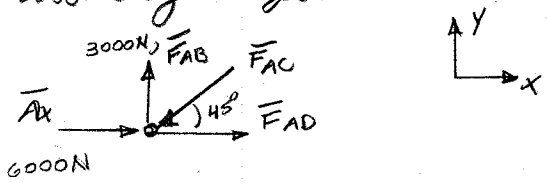
looking at point B




$\Sigma \bar{F}_x = 0 = (-6000N + F_{BC})\bar{i} \Rightarrow F_{BC} = 6000N\ (T)$

$\Sigma \bar{F}_y = 0 = (3000N - F_{AB})\bar{j} \Rightarrow F_{AB} = 3000N\ (T)$

looking at point A



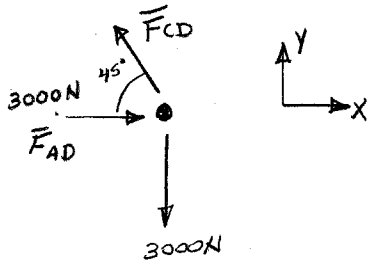

$\Sigma \bar{F}_x = 0 = (6000 + F_{AD} - F_{AC}\cos 45°)\bar{i}$

$\Sigma \bar{F}_y = 0 = (3000N - F_{AC}\sin 45°)\bar{j}$

$\therefore F_{AC} = 4243N\ (C)$

$F_{AD} = -3000N\ (C)$

Looking at pin D




$$\Sigma \bar{F}_X = 0 = (3000N - F_{CD}\cos 45^\circ)\,\bar{i} = 0$$

$$F_{CD} = 4243lb\ (T)$$

$F_{BC} = 6000N\ (T)$

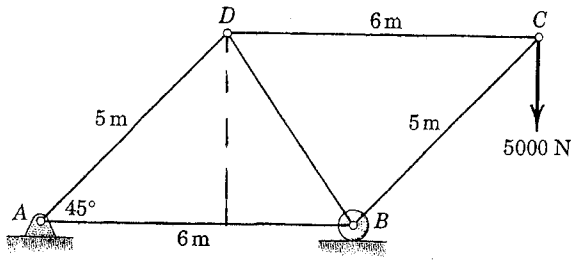
$F_{AB} = 3000N\ (T)$

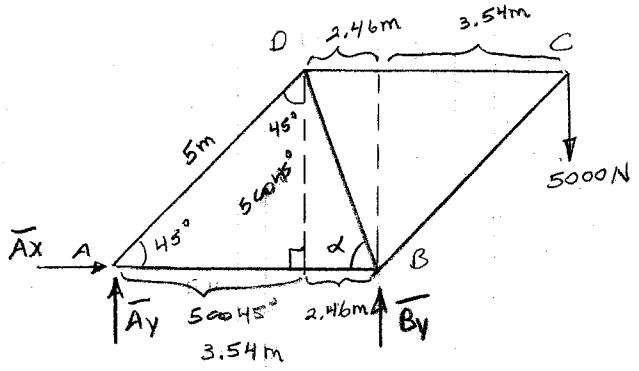
$F_{AC} = 4243N\ (C)$

$F_{AD} = 3000N\ (C)$

$F_{CD} = 4243lb\ (T)$

10C Determine the force in each member of the loaded truss shown below. Make sure to indicate whether the member is in tension or compression.




$\tan\alpha = \frac{3.54\text{m}}{2.46\text{m}}$

$\alpha = 55.2°$


$\Sigma \bar{F}_x = (A_x)\bar{i} = 0$

$\therefore A_x = 0$

$\Sigma \bar{F}_y = 0 = (A_y + B_y - 5000\text{N})\bar{j}$

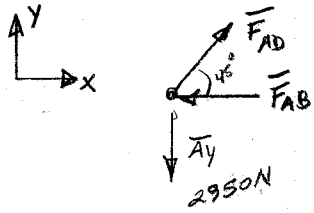
$\therefore A_y + B_y = 5000\text{N}$

$\Sigma \bar{M}_A = 0 = (B_y(6\text{m}) - 5000\text{N}(6 + 3.54\text{m}))\bar{k}$

$B_y = 7950\text{ N}$

$\therefore A_y = -2950\text{N}$ (wrong direction)

looking at pin A




$\Sigma \bar{F}_x = 0 = (F_{AD}\cos 45° - F_{AB})\bar{i}$

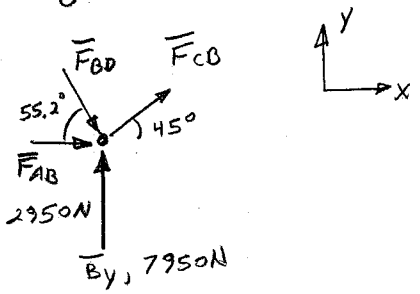
$\therefore F_{AB} = F_{AD}\cos 45°$

$\Sigma \bar{F}_y = 0 = (-2950\text{N} + F_{AD}\sin 45°)\bar{j}$

$\therefore F_{AD} = 4171\text{ N (T)}$

$\therefore F_{AB} = 2950\text{N (C)}$

Looking at pin B




$$\Sigma \bar{F}_x = (2950N + \bar{F}_{BD}\cos 55.2^\circ + F_{CB}\cos 45^\circ)\bar{i}$$

$$\Sigma \bar{F}_y = (-F_{BD}\sin 55.2 + F_{CB}\sin 45^\circ + 7950N)\bar{j}$$

(1) $\Sigma F_x \Rightarrow$ $.571 F_{BD} + .707 F_{CB} = -2950N$

(2) $\Sigma F_y \Rightarrow$ $-.821 F_{BD} + .707 F_{CB} = +7950N$

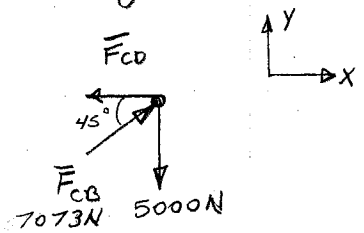
subtract eqn (2) from (1)

$(.571 + .821) F_{BD} + 0 = 5000N$

$F_{BD} = 3591N$ (C)

$\therefore F_{CB} = -7073$ N (C)

Looking at point C




$$\Sigma \bar{F}_x = 0 = (7073N\cos 45^\circ - F_{CD})\bar{i}$$

$\therefore F_{CD} = 5000N$ (T)

$F_{AB} = 2950N$ (C)

$F_{AD} = 4171N$ (T)

$F_{BD} = 3591N$ (C)

$F_{CB} = 7073N$ (C)

$F_{CD} = 5000N$ (T)