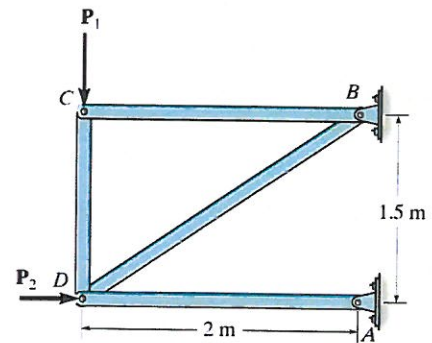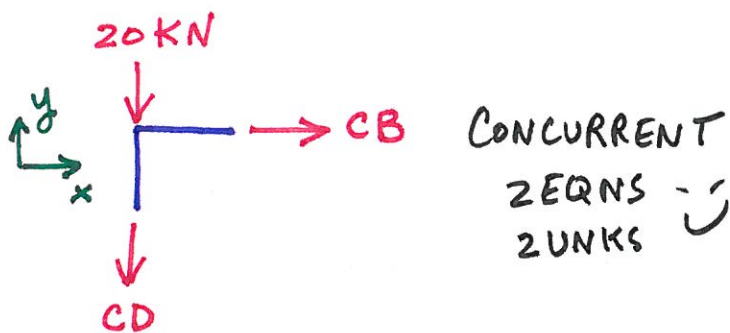Determine the force in each member of the truss and state if the members are in tension or compression. Set $P_1 = 20$ kN, $P_2 = 10$ kN.

Isolate Joints

FBD Joint C

20 KN

CB   CONCURRENT
2 EQNS 🙂
2 UNKS

CD

$$\twoheadrightarrow \Sigma F_x = 0 = CB \qquad \therefore \underline{CB = 0}$$

$$\uparrow \Sigma F_y = 0 = -20\,KN - CD \qquad \therefore \underline{CD = -20\,KN = 20.0\,KN\,(C)}$$

FBD JOINT D

20 KN
DB
10 KN → DA

$$\uparrow \Sigma F_y = 0 = -20 + DB\left(\tfrac{3}{5}\right)$$

$$\underline{DB = 33.3\,KN\,(T)}$$

$$\twoheadrightarrow \Sigma F_x = 0 = 10 + DB\left(\tfrac{4}{5}\right) + DA$$

$$0 = 10 + 33.3\left(\tfrac{4}{5}\right) + DA$$

$$\therefore DA = -36.7\,KN$$

$$\underline{DA = 36.7\,KN\,(C)}$$

Determine the force in each member of the truss, and state if the members are in tension or compression. Set $\theta = 30°$.

Support Reactions
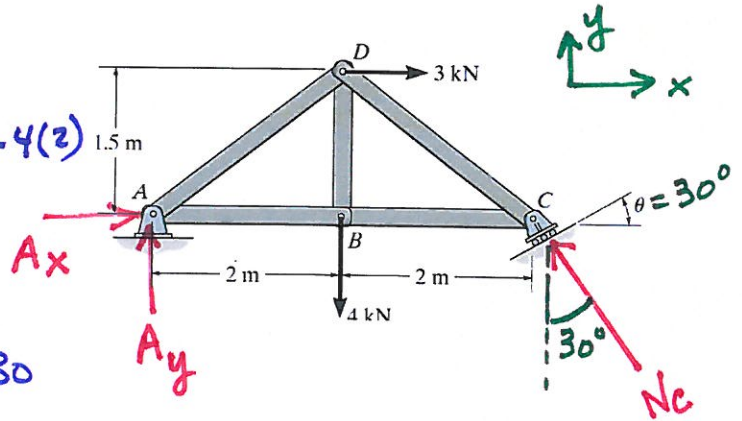
$$\zeta \Sigma M_A = 0 = N_C(\cos 30)4 - 3(1.5) - 4(2)$$

$$N_C = 3.608 \text{ kN}$$

$$\rightarrow \Sigma F_x = 0 = A_x + 3 - 3.608 \sin 30$$
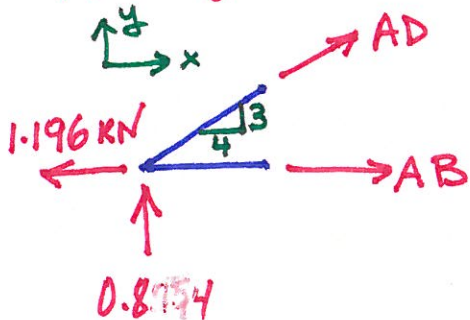
$$A_x = -1.196 \text{ KN} = 1.196 \text{ KN} \leftarrow$$

$$\uparrow \Sigma F_y = 0 = A_y - 4 + 3.608 \cos 30$$

$$A_y = 0.8754 \text{ KN} \uparrow$$

Isolate Joints

FBD Joint A

1.196 KN

0.8754

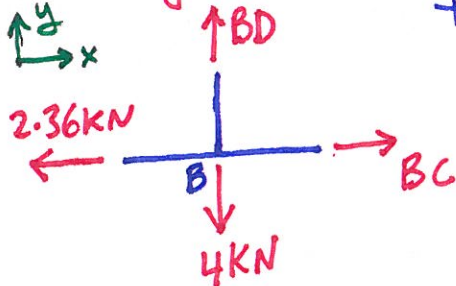$$\uparrow \Sigma F_y = 0 = 0.8754 + AD\left(\tfrac{3}{5}\right)$$

$$AD = -1.459 = 1.459 \text{ (C)}$$

$$\rightarrow \Sigma F_x = 0 = -1.196 + AD\left(\tfrac{4}{5}\right) + AB$$

$$0 = -1.196 - 1.459\left(\tfrac{4}{5}\right) + AB$$

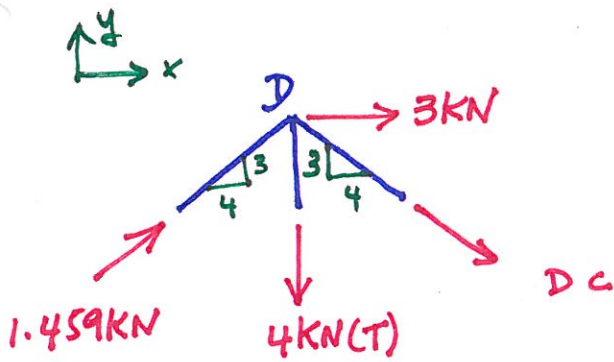$$AB = 2.36 \text{ KN (T)}$$

FBD Joint B

2.36KN

4KN

$$\rightarrow \Sigma F_x = 0 = -2.36 + BC$$

$$BC = 2.36 \text{ KN (T)}$$

$$\uparrow \Sigma F_y = 0 = -4 + BD$$
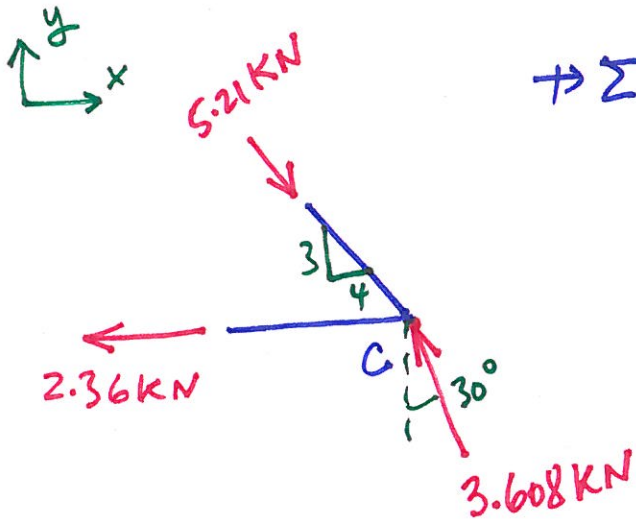
$$BD = 4 \text{ KN (T)}$$

FBD JOINT D

$$\rightarrow \Sigma F_x = 0 = 1.459\left(\tfrac{4}{5}\right) + 3 + DC\left(\tfrac{4}{5}\right)$$

$$DC = -5.21 \text{ KN}$$

$$\underline{DC = 5.21 \text{ KN (C)}}$$

CHECK FBD JOINT C

$$\rightarrow \Sigma F_x = -2.36 + 5.21\left(\tfrac{4}{5}\right) - 3.608 \sin 30$$

$$= -2.36 + 4.168 - 1.804 = 0.004$$

$$= 0 \quad \underline{\underline{O.K.}}$$

$$\uparrow \Sigma F_y = 3.608 \cos 30 - 5.21\left(\tfrac{3}{5}\right)$$

$$= -0.001$$

$$= 0 \quad \underline{\underline{O.K.}}$$