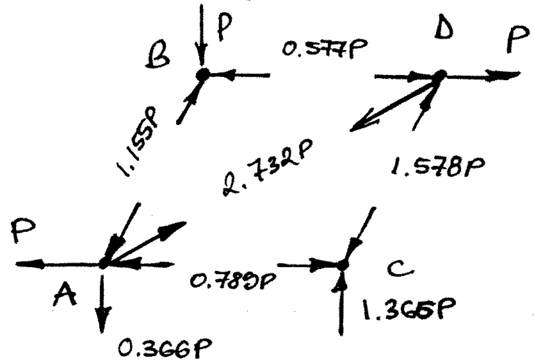
SOLUTIONS TO ASSIGNMENT

1. By using the method of joints to solve for the member forces in the truss the following forces are obtained in terms of the applied forces, P:



- The maximum compression force occurs in member CD and is $C = 1.578P$. This force must NOT exceed the maximum allowable compressive force of 1.2 kN. Therefore, $P \leq 0.761$ kN.
- The maximum tensile force occurs in member AB and is $T = 2.732P$. This force must NOT exceed the maximum allowable tensile force of 2 kN. Therefore $P \leq 0.732$ kN.

$\therefore$ Since both inequalities must be satisfied, $P_{max} = 0.732$ kN.

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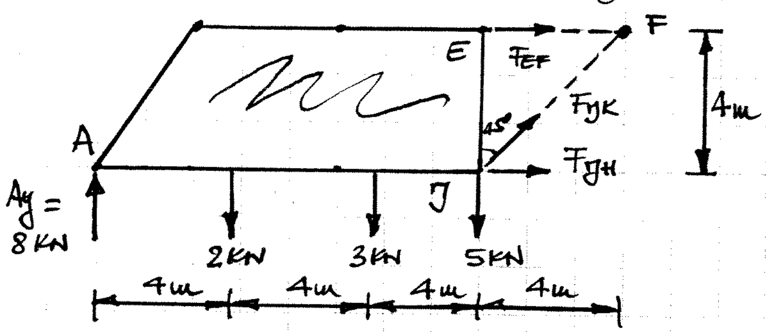
2. By calculating $\Sigma M_D = 0$ the vertical reaction at A can be calculated:
$-A_y(24) + 2(20) + 3(16) + 5(12) + 4(8) + 3(4) = 0 \quad \therefore A_y = 8.00$ kN ↑
Also, $\Sigma F_x = 0 \quad \therefore A_x = 0$. Then, cut the truss through the three unknown force members and analyse, say, the LHS of the resulting FBDs:



$\Sigma M_F = 0 \quad F_{JH}(4) + 5(4) + 3(8) + 2(12) - 8(16) = 0 \quad \therefore F_{JH} = 15.00$ kN (T)

$\Sigma F_y = 0 \quad 8 - 2 - 3 - 5 + F_{JK}\cos 45° = 0$
$\therefore F_{JK} = 2.83$ kN (T)

$\Sigma F_x = 0 \quad 15 + F_{JK}\sin 45° + F_{EF} = 0$

$\therefore F_{EF} = -17.00$ kN $= 17.00$ kN (C) Note: The minus sign of F_{EF} indicates that our initial assumption that the member was in tension was incorrect, and the member is in fact in compression.

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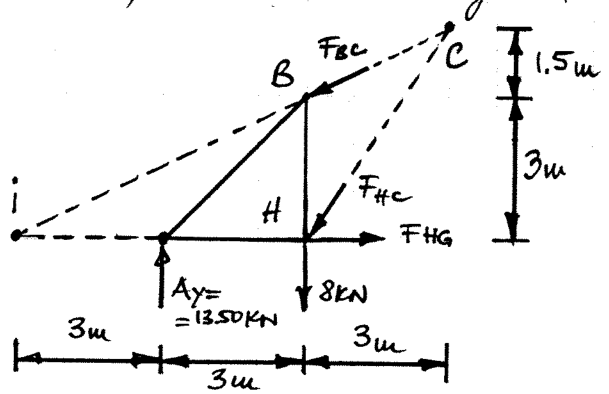
3. By calculating $\Sigma M_E = 0$ the vertical reaction at A can be calculated:
$-A_y(12) + 8(9) + 12(6) + 6(3) = 0 \quad \therefore A_y = 13.50$ kN ↑ and $A_x = 0$
Then, cut the truss through members HG, HC, BC and analyse the LHS of the FBD:



In order to use a single equation of equilibrium to calculate each unknown force ONLY moment equations can be used, and they must be written about points about which the moments produced by the other two unknowns are zero. Remember, moments can be calculated about points located on or off the body.

$\sum M_C = 0$ is an equation containing F_{HG} as the only unknown:

$+F_{HG}(4.5) + 8(3) - 13.5(6) = 0 \quad \therefore \underline{\underline{F_{HG} = 12.67 \text{ KN (T)}}}$

$\sum M_H = 0$ is an equation containing F_{BC} as the only unknown:

$$-13.5(3) + \underbrace{F_{BC}\frac{3}{\sqrt{11.25}}}_{F_{BC_x}}(3) = 0 \quad \therefore \underline{\underline{F_{BC} = 15.09 \text{ KN (C)}}}$$

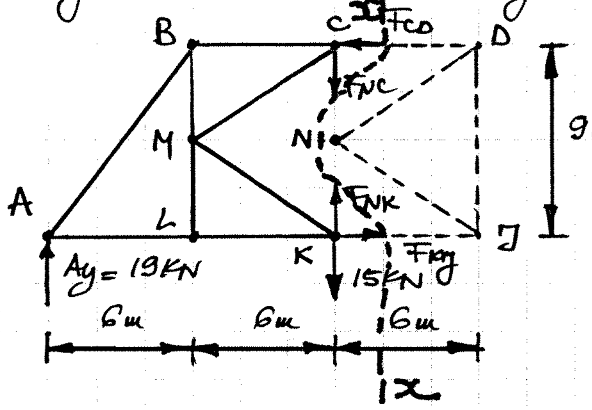
$\sum M_I = 0$ is an equation containing F_{HC} as the only unknown:

$$13.5(3) - 8(6) - \underbrace{F_{HC}\frac{4.5}{\sqrt{29.25}}}_{F_{HC_y}}(6) = 0 \quad \therefore \underline{\underline{F_{HC} = 1.502 \text{ KN (T)}}}$$

4.1 By calculating $\sum M_G = 0$ the vertical reaction at A can be calculated:

$-A_y(36) + 15(24) + 18(18) = 0 \quad \therefore A_y = 19.00 \text{ KN} \uparrow$ and $A_x = 0$.

The only way this truss can be cut is through at least four members of unknown forces, but if it is cut through members CD, CN, NK and KJ one can write moment equations about points C and K and these equations will only contain F_{CD} and F_{KJ} as unknowns; hence use cut x-x and the resulting LHS of the FBDs:



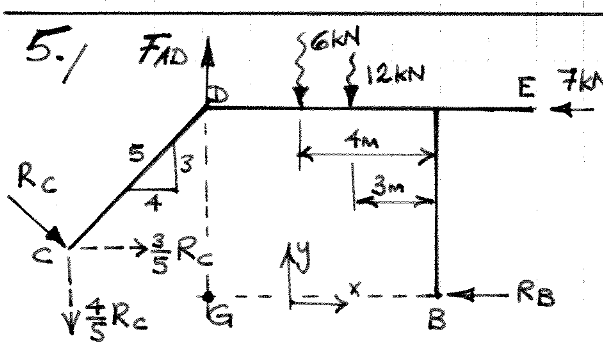
$\sum M_C = 0 \quad F_{KJ}(9) - A_y(12) = 0$ (19)

$\therefore \underline{\underline{F_{KJ} = 25.3 \text{ KN (T)}}}$

$\sum M_K = 0 \quad F_{CD}(9) - 19(12) = 0$

$\therefore \underline{\underline{F_{CD} = 25.3 \text{ KN (C)}}}$

5.1



$\sum M_G = 0 \quad \therefore -7(5) + 6(4) + 12(5) + \frac{3}{5}R_C(2) - \frac{4}{5}R_C(4) = 0$

$\therefore -35 + 24 + 60 + \frac{6}{5}R_C - \frac{16}{5}R_C = 0$

$\therefore \underline{\underline{R_C = 24.5 \text{ kN}}}$

$\sum F_x = 0 \quad \therefore \frac{3}{5}(24.5) - 7 - R_B = 0 \quad \therefore \underline{\underline{R_B = 7.70 \text{ kN}}} \leftarrow$

$\sum F_y = 0 \quad \therefore F_{AD} - 6 - 12 - \frac{4}{5}(24.5) = 0$

$\therefore \underline{\underline{F_{AD} = 37.6 \text{ kN TENSION}}}$