

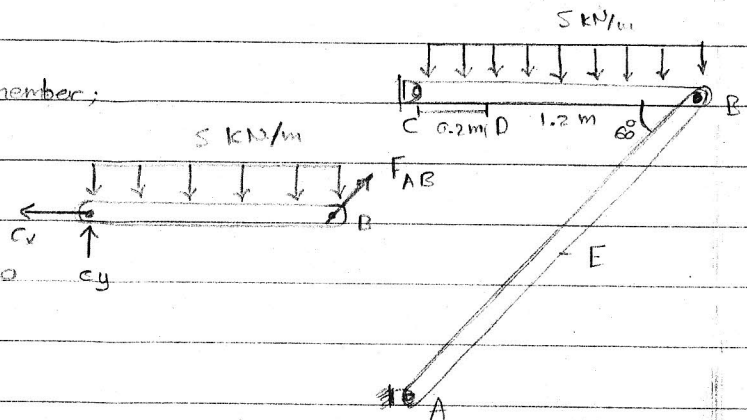
# HW # 1   Key Solutions

HW 01

02 02 13

Q.1

Member AB is a two force member;



$$\sum M_C = 0$$

$$\Rightarrow -(5 \cdot 1.2 \cdot 0.6) + (F_{AB} \sin 60 \cdot 1.2) = 0$$

$$\Rightarrow F_{AB} = 3.46 \text{ kN}$$

$$\sum F_x = 0$$

$$\Rightarrow -C_x + 3.46 \cos 60 = 0$$

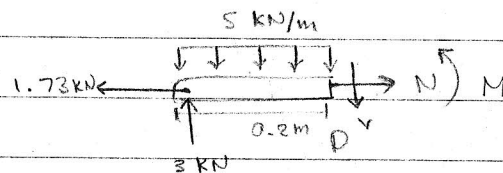
$$\Rightarrow C_x = 1.73 \text{ kN}$$

$$\sum F_y = 0$$

$$C_y - (5 \cdot 1.2) + 3.46 \sin 60 = 0$$

$$\Rightarrow C_y = 3.00 \text{ kN}$$

For Point D:



$$\sum F_x = 0$$

$$\Rightarrow N - 1.73 = 0 \quad \Rightarrow N = 1.73 \text{ kN}$$

$$\sum F_y = 0$$

$$\Rightarrow 3 - (5 \cdot 0.2) - V = 0 \quad \Rightarrow V = 2 \text{ kN}$$

$$\sum M_D = 0$$

$$\Rightarrow (5 \cdot 0.2 \cdot 0.1) - (3 \cdot 0.2) + M = 0$$

$$\Rightarrow M = 0.5 \text{ kN}\cdot\text{m}$$

For point F:

$$\frac{1.2}{L} = \cos 60 \Rightarrow L = 2.4 \text{ m}$$

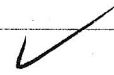
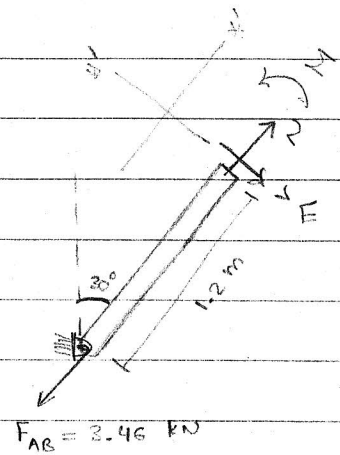
$$\sum F_{x'} = 0$$

$$\Rightarrow N = 3.46 \text{ kN} \Rightarrow N = 3.46 \text{ kN}$$

$$\sum F_{y'} = 0$$

$$\Rightarrow -V = 0 \Rightarrow V = 0 \text{ kN}$$

$$\sum M_F = 0 \Rightarrow M = 0$$



$\frac{25}{25}$

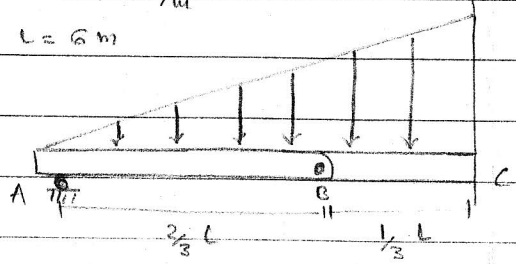
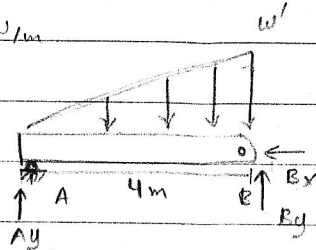
Q.2

Support reactions;

$$\frac{9}{6} = \frac{w'}{4} \Rightarrow w' = 6 \text{ KN/m}$$

$$w = 9 \text{ KN/m}$$

$$L = 6 \text{ m}$$



$$\sum M_B = 0$$

$$\Rightarrow -(A_y \cdot 4) + \left(\frac{1}{2} \cdot 4 \cdot 6 \cdot \frac{4}{3}\right) = 0$$

$$\Rightarrow A_y = 4 \text{ KN}$$

$$\sum F_x = 0$$

$$\Rightarrow B_x = 0$$

$$\sum F_y = 0$$

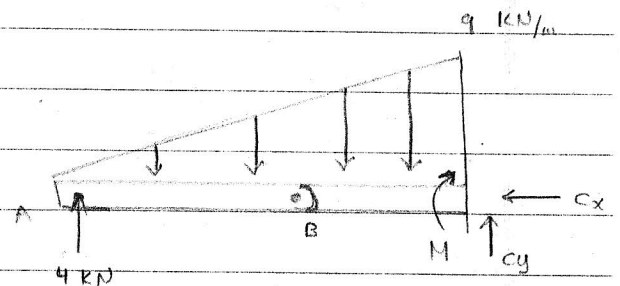
$$\Rightarrow 4 - \left(6 \cdot \frac{1}{2} \cdot 4\right) + B_y = 0$$

$$\Rightarrow B_y = 8 \text{ KN}$$

For the whole body;

$$\sum F_x = 0$$

$$\Rightarrow C_x = 0$$



$$\sum F_y = 0$$

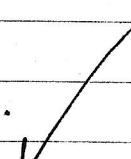
$$\Rightarrow 4 - \left(\frac{1}{2} \cdot 9 \cdot 6\right) + C_y = 0$$

$$\Rightarrow C_y = 23 \text{ KN}$$

$$\sum M_C = 0$$

$$\Rightarrow -(4 \cdot 6) + \left(\frac{1}{2} \cdot 6 \cdot 9 \cdot \frac{6}{3}\right) - M = 0$$

$$\Rightarrow M = 30 \text{ KN}\cdot\text{m}$$

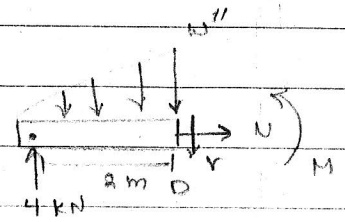


~~25~~  
25

For Point D ;

$$\frac{q}{6} = \frac{w''}{2} \Rightarrow w'' = 3 \text{ kN/m}$$

$$\sum F_x = 0 \Rightarrow N = 0$$



$$\sum F_y = 0$$

$$\Rightarrow 4 - \left(\frac{1}{2} \cdot 3 \cdot 2\right) - r = 0$$

$$\Rightarrow v = 1 \text{ kN}$$

$$\sum M_D = 0$$

$$\Rightarrow -(4 \cdot 2) + \left(\frac{1}{2} \cdot 3 \cdot 2 \cdot \frac{2}{3}\right) + M = 0$$

$$\Rightarrow M = 6 \text{ kN} \cdot \text{m}$$



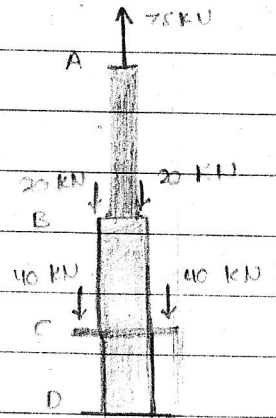
Q.3

Given:  $d_{AB} = 20 \text{ mm}$ ;  $d_{BC} = d_{CD} = 30 \text{ mm}$ .

For AB;

$$\sum F_y = 0$$

$$\Rightarrow 75 - P = 0 \quad \Rightarrow P = 75 \text{ kN}$$

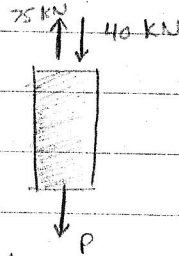


$$\sigma_{AB} = \frac{75 \times 10^3}{\frac{\pi}{4} (20)^2} = 238.7 \text{ MPa (T)}$$

For BC;

$$\sum F_y = 0$$

$$\Rightarrow 75 - 40 - P = 0 \quad \Rightarrow P = 35 \text{ kN}$$

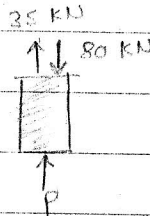


$$\sigma_{BC} = \frac{35 \times 10^3}{\frac{\pi}{4} (30)^2} = 49.51 \text{ MPa}$$

For CD;

$$\sum F_y = 0$$

$$\Rightarrow 35 - 80 + P = 0 \quad \Rightarrow P = 45 \text{ kN}$$



$$\sigma_{CD} = \frac{45 \times 10^3}{\frac{\pi}{4} (30)^2} = 63.66 \text{ MPa (C)}$$



25  
25

Q4

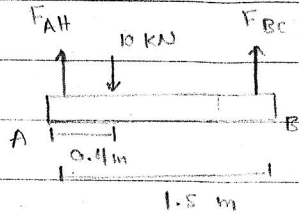
Given:  $A = 200 \text{ mm}^2$ 

For section 1;

$$\Sigma M_A = 0$$

$$\Rightarrow -(10 \cdot 0.4) + (F_{BC} \cdot 1.5) = 0$$

$$\Rightarrow F_{BC} = 2.67 \text{ kN}$$

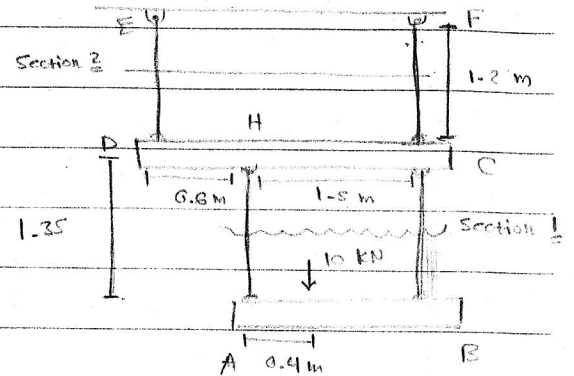


$$\Sigma F_y = 0$$

$$\Rightarrow F_{AH} - 10 + 2.67 = 0$$

$$\Rightarrow F_{AH} = 7.33 \text{ kN}$$

$$\sigma_{BC} = \frac{2.67 \times 10^3}{200} = 13.35 \text{ MPa} ; \sigma_{AH} = \frac{7.33 \times 10^3}{200} = 36.65 \text{ MPa}$$

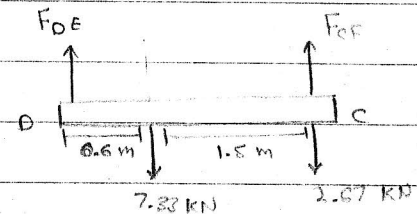


For section 2;

$$\Sigma M_D = 0$$

$$\Rightarrow -(7.33 \cdot 0.6) - (2.67 \cdot 2.1) + (F_{CF} \cdot 3.1) = 0$$

$$\Rightarrow F_{CF} = 4.76 \text{ kN}$$



$$\Sigma F_y = 0$$

$$\Rightarrow F_{DE} - 7.33 - 2.67 + 4.76 = 0$$

$$\Rightarrow F_{DE} = 5.24 \text{ kN}$$

$$\sigma_{DE} = \frac{5.24 \times 10^3}{200} = 26.2 \text{ MPa} ; \sigma_{CF} = \frac{4.76 \times 10^3}{200} = 23.8 \text{ MPa}$$

25

25