(Q1) Due to symmetrical loading on the truss.
Vertical components of the reaction at A and H are equal.

$$F_{AB} = F_{FH} \quad F_{AC} = F_{GH} \quad F_{BC} = F_{FG} \quad F_{CE} = F_{EG}$$

$$F_{BE} = F_{EF} \quad F_{BD} = F_{DF}$$

$$\theta = \tan^{-1}\left(\frac{4}{3}\right) = 53,13°$$
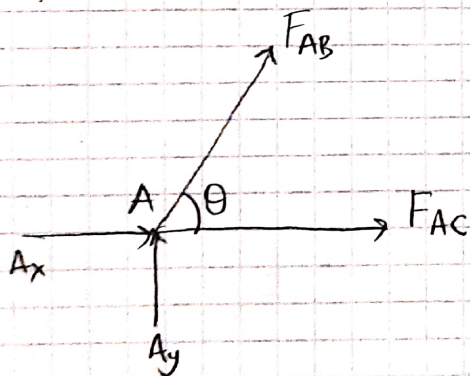
$$\Sigma F_x = 0$$
$$A_x = 0$$

$$\Sigma F_y = 0$$
$$A_y + H_y - 6-6-6 = 0$$
$$A_y + A_y - 18 = 0 \quad \text{due to symmetry, } A_y = H_y$$
$$A_y = 9 kN = H_y$$

Free body diagram at Joint A.

$$\Sigma F_y = 0$$
$$F_{AB} \sin\theta + A_y = 0$$
$$F_{AB} \sin 53,13° + 9 = 0$$
$$F_{AB} = -9,79 \, kN$$
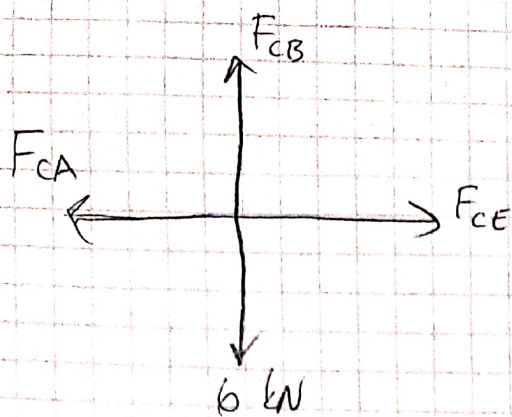
$$\Sigma F_x = 0$$
$$F_{AC} + F_{AB} \cos\theta - A_x = 0$$
$$F_{AC} + 9,79 \cos 53,13° - 0 = 0$$
$$F_{AC} = 5,87 \, kN = F_{GH}$$

Free body diagram at point C.

$$\Sigma F_x = 0$$

$$F_{CE} - F_{CA} = 0$$

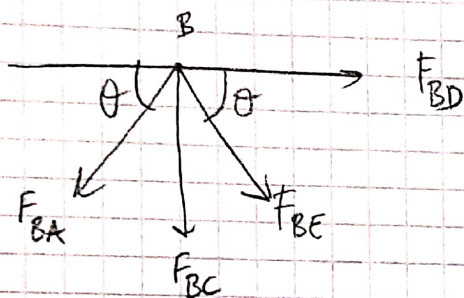$$F_{CE} - 5.87 = 0$$

$$F_{CE} = 5.87 \, kN = F_{EG}$$

$$\Sigma F_y = 0$$

$$F_{CB} - 6 = 0$$

$$F_{CB} = 6 \, kN$$

$$\Sigma F_y = 0$$

$$-F_{BA} \sin\theta - F_{BC} - F_{BE} \sin\theta = 0$$
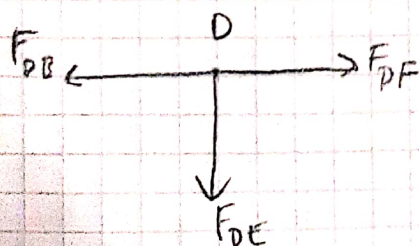
$$-(-9.79) \sin 53.13 - (6) - F_{BE} \sin 53.13° = 0$$

$$F_{BE} = 2.29 \, kN$$

$$\Sigma F_x = 0$$

$$F_{BD} + F_{BE} \cos\theta - F_{BA} \cos\theta = 0$$

$$F_{BD} + (2.29) \cos 53.13 - (-9.79) \cos 53.13° = 0$$

$$F_{BD} = -7.24 \, kN$$
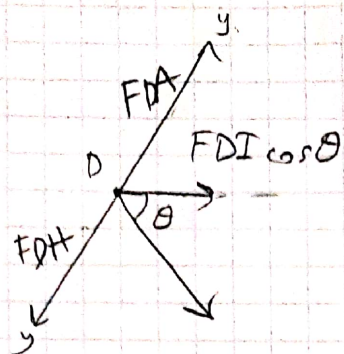

$$\Sigma F_y = 0$$
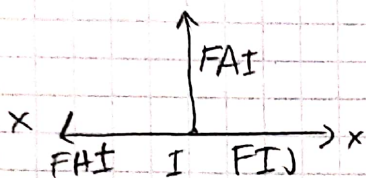
$$-F_{DE} = 0$$

$$F_{DE} = 0$$

(Q.2)

at Joint D

$\Sigma F_x = 0$

$FDI \cos\theta = 0$

$\cos\theta = 0$

$FDI = 0$

similarly $FEI = 0$

at Joint I

$\Sigma F_y = 0$

$FAI = 0$

Similarly $FBJ = 0$, $FCK = 0$

$FFK = 0$, $F K = 0$

(Q.3)

$\Sigma M_A = 0$

(4)

$$\sum M_F = -A_y \times 10.8 - 4.5 \times 12 = 0$$

$$A_y = -5 \text{ kips}$$

$$\sum F_x = 0 \quad A_x = 4.5 \text{ kips}$$

$$\sum M_c = B \times 12 - 4.5 \times 18 + 5 \times 10.8 = 0$$

$$B = -2.25 \text{ kips}$$

$$\sum F_x = C_x + 2.25 - 4.5 = 0$$

$$C_x = 2.25 \text{ kips}$$

$$\sum F_y = C_y - 5 = 0$$

$$C_y = 5 \text{ kips}$$