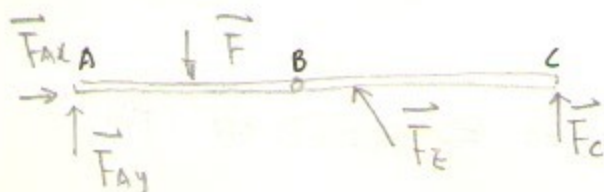
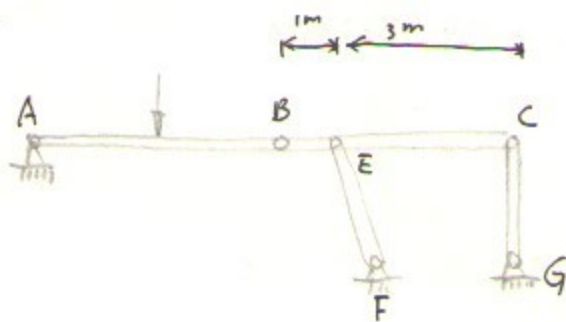


# HW 4

例3. 求图示复合梁 AB, BC, EF, CG. 如图所示相连接. 已知 AB 中点力  $F = 1\text{kN}$ , 求 A 支反力和 EF, CG 的内力大小.

二: 由受力分析可知, EF, CG 为二力杆

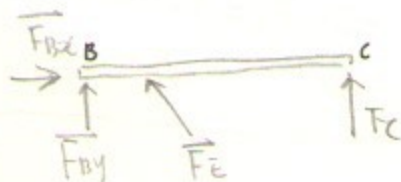
对杆 ABC, 受力分析如图:



[AEC]: 对 A 点取矩, 有

$$F \cdot 2 - F_E \frac{\sqrt{2}}{2} \cdot 5 - F_C \cdot 8 = 0 \quad (1)$$

对 BC 杆, 受力分析如图:



[BC], 对 B 点取矩:  $F_E \cdot \frac{\sqrt{2}}{2} \cdot 1 + F_C \cdot 4 = 0$

$$\Rightarrow \frac{\sqrt{2}}{2} F_E = -4 F_C \quad (2)$$

由 (1) 和 (2) 有:

$$\begin{cases} F_C = -\frac{F}{8} = -167\text{N} (\downarrow) \\ F_E = -4\sqrt{2} F_C = 943\text{N} (\uparrow) \end{cases}$$

对整体, 有  $\sum F_x = 0 \Rightarrow F_{Ax} - F_E \cdot \frac{\sqrt{2}}{2} = 0 \Rightarrow F_{Ax} = 667\text{N} (\rightarrow)$

$$\sum F_y = 0 \Rightarrow F - F_{Ay} - \frac{\sqrt{2}}{2} F_E - F_C = 0$$

$$\Rightarrow F_{Ay} = F - \frac{\sqrt{2}}{2} F_E - F_C = 500\text{N} (\uparrow)$$

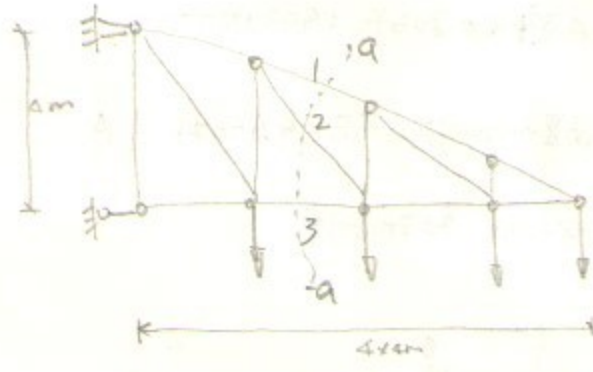
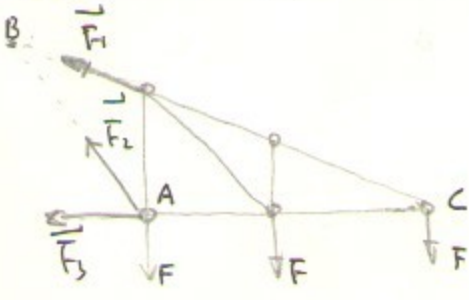
综上: EF 内力为  $943\text{N}$  (受压), CG 的内力为  $-167\text{N}$  (受拉)

$$F_{Ax} = 667\text{N} (\rightarrow), F_{Ay} = 500\text{N} (\uparrow)$$

例3-17, 求图示平面桁架中杆1, 2, 3杆内力, 已知  $F = 20 \text{ kN}$ , 自重不计

二: 用截面法, 如图示:

取截面 a-a 右侧, 受力如图

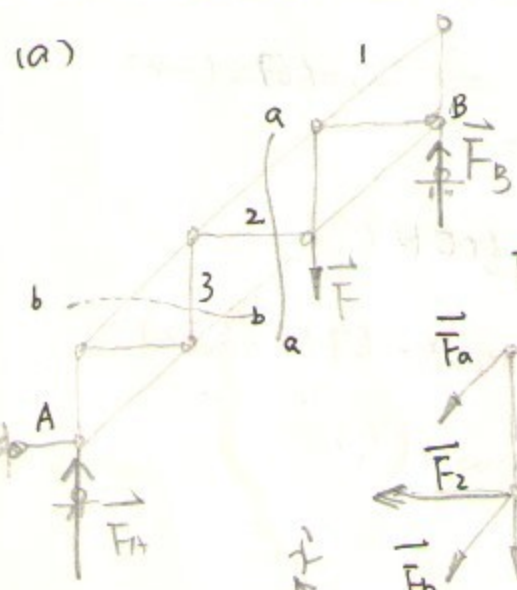


有:  $\sum M_A = 0 \Rightarrow F_1 \cdot 4 \cdot \frac{2}{\sqrt{5}} - F \cdot 4 - F \cdot 8 = 0 \Rightarrow F_1 = 67.1 \text{ kN (拉)}$

$\sum M_B = 0 \Rightarrow F_3 \cdot 6 + F \cdot 4 + F \cdot 8 + F \cdot 12 = 0 \Rightarrow F_3 = -4F = -80 \text{ kN (压)}$

$\sum M_C = 0 \Rightarrow F_2 \frac{3}{\sqrt{13}} \cdot 8 - 8 \cdot F - 4 \cdot F = 0 \Rightarrow F_2 = 36.1 \text{ kN (拉)}$

例3-18 用适当方法求图中桁架中指述杆的内力



二: 由观察可知, 1杆为零力杆.

对整体受力分析平衡方程可知,

$F_B = \frac{2}{3}F (\uparrow) \quad F_A = \frac{1}{3}F (\downarrow)$

取截面 a-a 右侧分离体, 受力如图, 有

取 x 方向  $\sum F_x = 0 \Rightarrow$

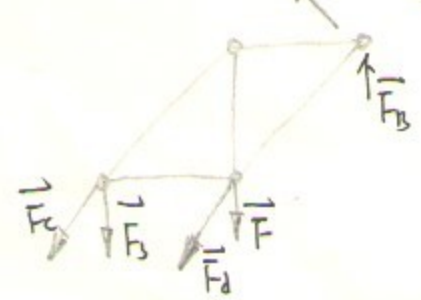
$F_2 \cdot \frac{\sqrt{2}}{2} + \frac{2}{3}F \cdot \frac{\sqrt{2}}{2} - F \cdot \frac{\sqrt{2}}{2} = 0$

$\Rightarrow F_2 = \frac{1}{3}F (\text{拉})$

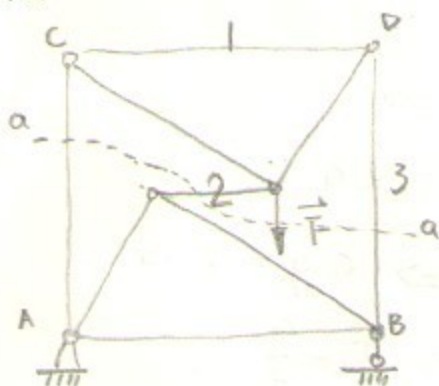
取截面 b-b 右侧分离体, 受力分析如图, 有

取 x 方向,  $\sum F_x = 0 \Rightarrow$

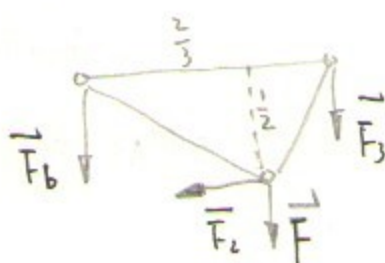
$-F_3 \cdot \frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2}F + \frac{2}{3}F \cdot \frac{\sqrt{2}}{2} = 0 \Rightarrow F_3 = \frac{1}{3}F (\text{压})$



(b)

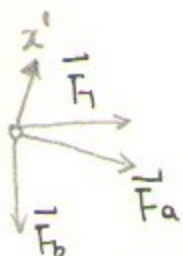


2. 取 a-a 截面上部受力分析



易得:  $F_2 = 0$ ,  $F_3 = -\frac{2}{3}F$  (压)  $F_b = -\frac{1}{3}F$  (压)

取节点 C



沿 x 方向有:

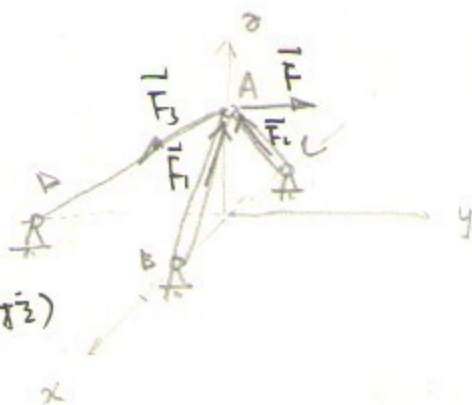
$$F_1 = \frac{4}{3}F_b = -\frac{4}{9}F \text{ (压)}$$

3-23. 天线由 AB 和 AC 及拉线 AD 构成, 已知 F 作用在 Oyz 平面且与 Oy 平行,  $F = 900\text{N}$ , 求拉线及支柱受到的力。

对节点 A 受力分析如图:

$$\sum F_y = 0 \Rightarrow \frac{\sqrt{3}}{2}F_3 - F = 0$$

$$\Rightarrow F_3 = \frac{2}{\sqrt{3}} \cdot 900\text{N} = 1039\text{N} \text{ (拉)}$$

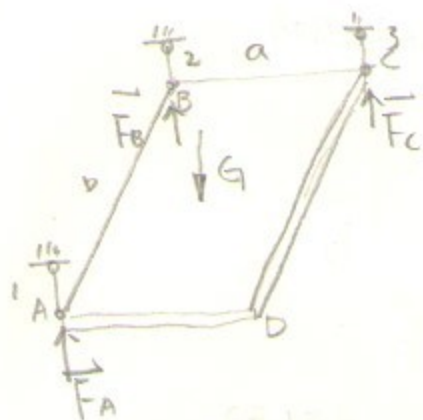


$$\sum F_x = 0 \Rightarrow F_1 = F_2$$

$$\sum F_z = 0 \Rightarrow 2 \cdot \frac{\sqrt{3}}{2}F_1 = \frac{1}{2}F_3 \Rightarrow F_1 = F_2 = \frac{F_3}{2\sqrt{3}} = 300\text{N} \text{ (压)}$$



3-25. 长方形板 ABCD 宽度  $a$ , 高度  $b$ , 重  $G$ , ABC 三角用铅垂杆悬挂, 求三杆内力



$$\sum F_y = 0 \Rightarrow$$

$$F_A + F_B + F_C = G$$

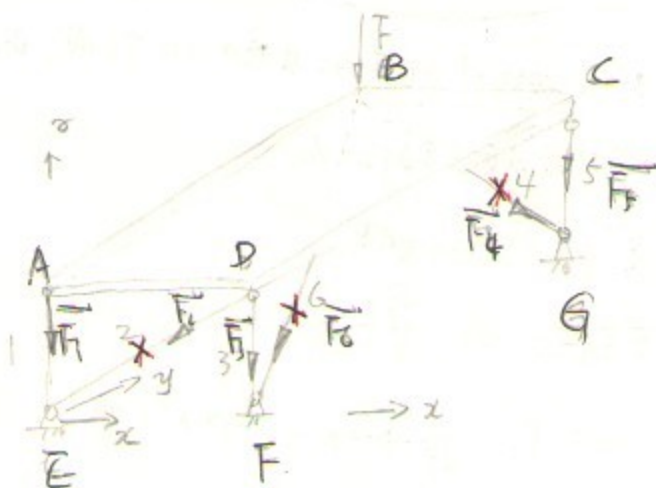
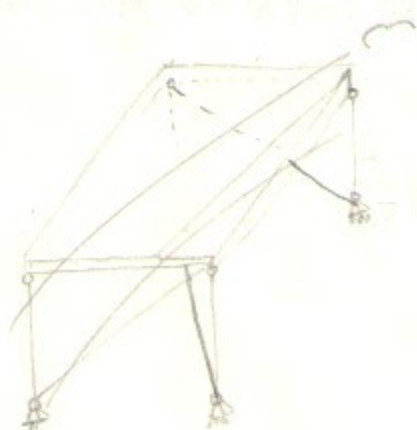
$$\sum M_{AB} = 0 \Rightarrow G \cdot \frac{a}{2} = F_C \cdot a$$

$$\Rightarrow F_C = \frac{G}{2}$$

$$\sum M_{DC} = 0 \Rightarrow F_A = \frac{G}{2}$$

$$\therefore F_B = 0$$

3-26 图示矩形板, 六根互杆支撑, 已知  $F$ , 求各杆内力



取力矩如图, 平衡方程

$$\sum F_y = 0 \Rightarrow F_6 = 0$$

$$\sum F_x = 0 \Rightarrow F_4 = F_2$$

$$\sum M_{BF} = 0 \Rightarrow F_4 = 0 \Rightarrow F_4 = F_2 = 0$$

$$\sum M_{AB} = \sum M_{DC} = 0 \Rightarrow F_1 = -F$$

$$\begin{cases} F_1 = -F \\ F_2 = 0 \\ F_3 = F \\ F_4 = 0 \\ F_5 = -F \\ F_6 = 0 \end{cases}$$

$$\sum M_{AD} = 0 \Rightarrow$$

$$F_5 = -F$$

$$\sum F_y = 0 \Rightarrow$$

$$F_1 + F_3 + F_5 + F = 0$$

$$\Rightarrow F_3 = F \quad (\#)$$