



石家莊鐵道大學
SHIJIAZHUANG TIEDAO UNIVERSITY

在线开放课程

习题课

平面任意力系平衡方程

主讲：薛雁

习题课-平面任意力系平衡方程



在线开放课程

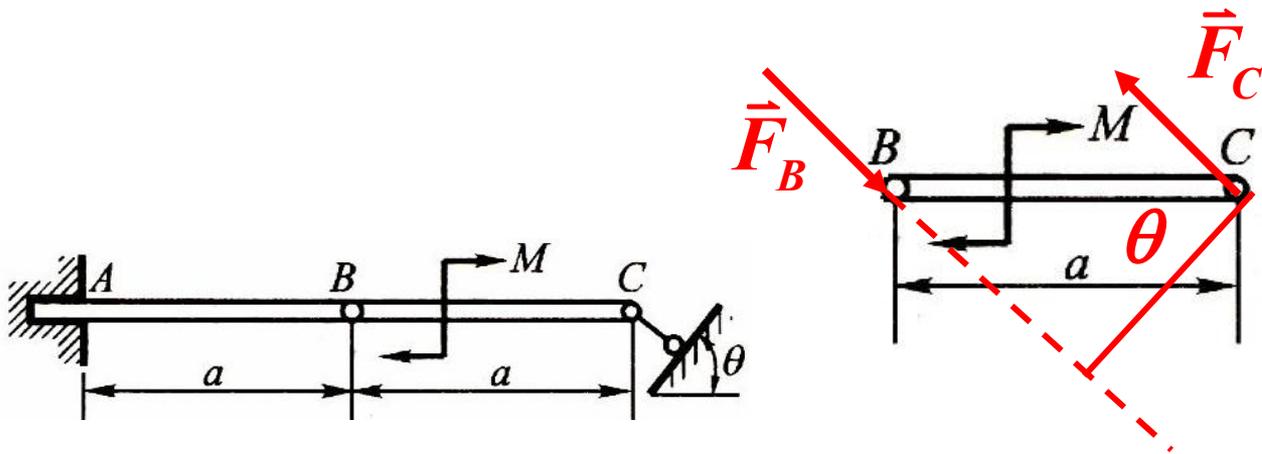
- 一、平面任意力系-习题1
- 二、平面任意力系-习题2
- 三、平面任意力系-习题3

一、平面任意力系-习题1

求各梁在A、B、C处的约束反力。

解：(1) 取BC构件：

$$\sum M_i = 0 \quad F_C \cdot a \cos \theta - M = 0 \quad F_B = F_C = M / a \cos \theta$$



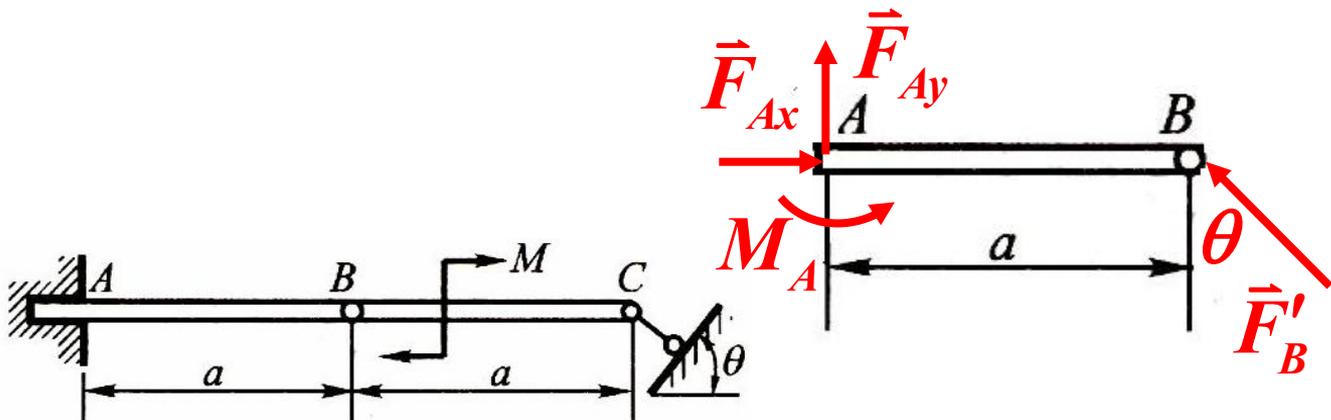
一、平面任意力系-习题1

求各梁在A、B、C处的约束反力。

解：(2) 取AB构件：

$$F'_B = F_B = M/a \cos \theta$$

$$\sum F_x = 0 \quad F_{Ax} - F'_B \sin \theta = 0 \quad F_{Ax} = M \tan \theta / a$$



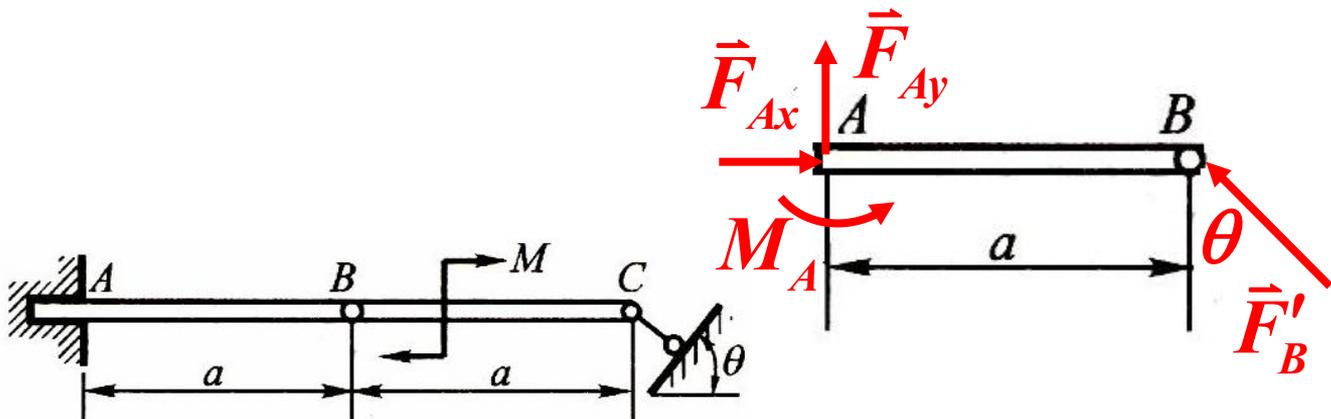
一、平面任意力系-习题1

求各梁在A、B、C处的约束反力。

解：(2) 取AB构件：

$$F'_B = F_B = M/a \cos \theta$$

$$\sum F_y = 0 \quad F_{Ay} + F'_B \cos \theta = 0 \quad F_{Ay} = -M/a$$



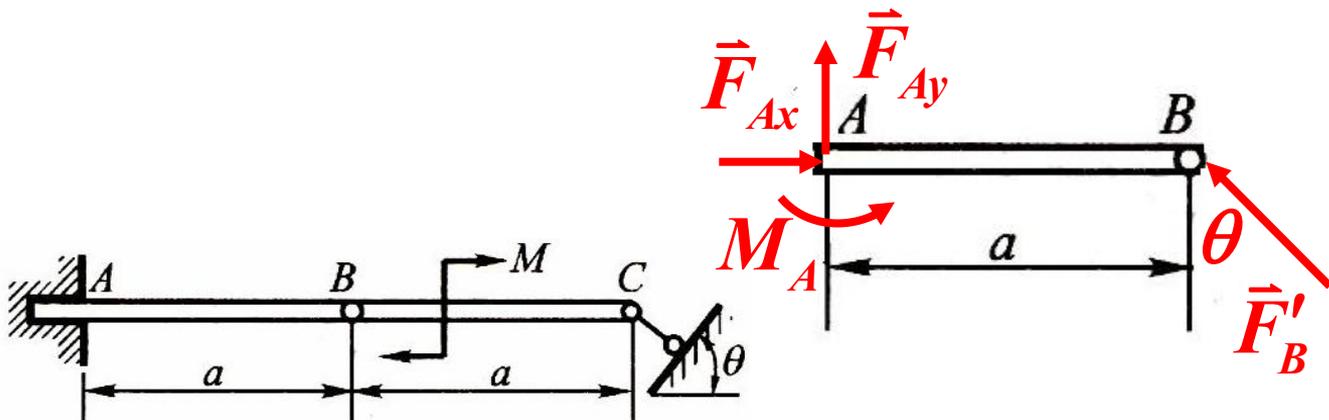
一、平面任意力系-习题1

求各梁在A、B、C处的约束反力。

解：(2) 取AB构件：

$$F'_B = F_B = M/a \cos \theta$$

$$\sum M_A = 0 \quad M_A + F'_B \cos \theta \cdot a = 0 \quad M_A = -M$$

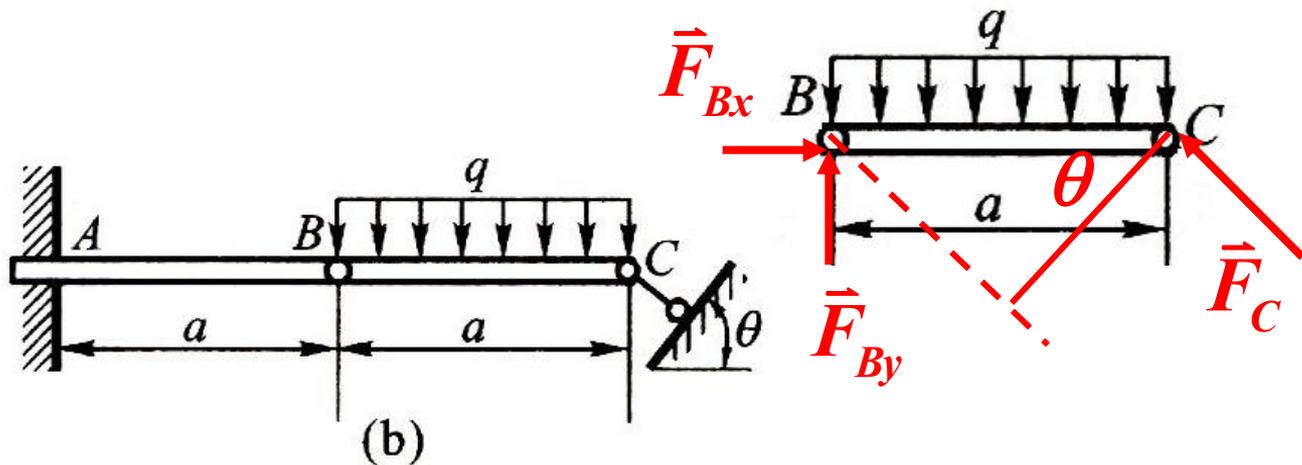


二、平面任意力系-习题2

求各梁在A、B、C处的约束反力。

解：(1) 取BC构件：

$$\sum M_B = 0 \quad -qa^2/2 + F_C \cdot a \cos \theta = 0 \quad F_C = qa/2 \cos \theta$$



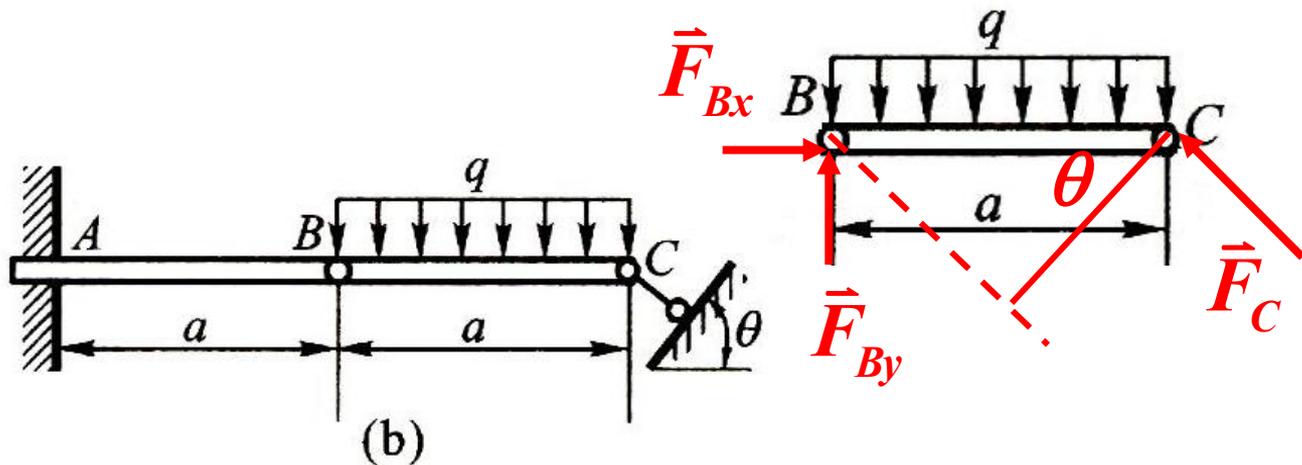
二、平面任意力系-习题2

求各梁在A、B、C处的约束反力。

解：(1) 取BC构件：

$$F_C = qa/2 \cos \theta$$

$$\sum F_x = 0 \quad F_{Bx} - F_C \sin \theta = 0 \quad F_{Bx} = qa \tan \theta / 2$$



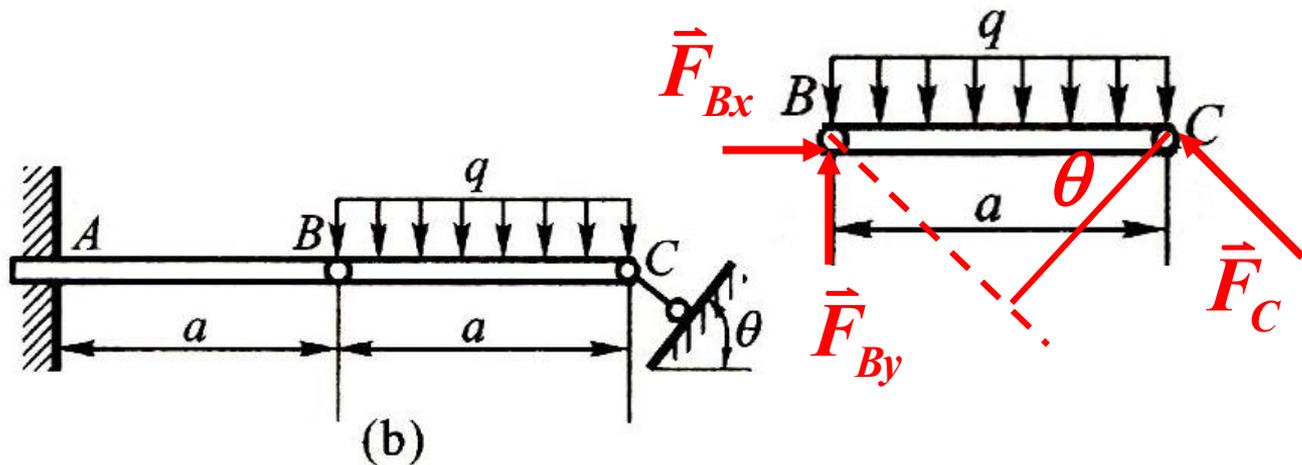
二、平面任意力系-习题2

求各梁在A、B、C处的约束反力。

解：(1) 取BC构件：

$$F_C = qa/2 \cos \theta$$

$$\sum F_y = 0 \quad F_{By} - qa + F_C \cos \theta = 0 \quad F_{By} = qa/2$$



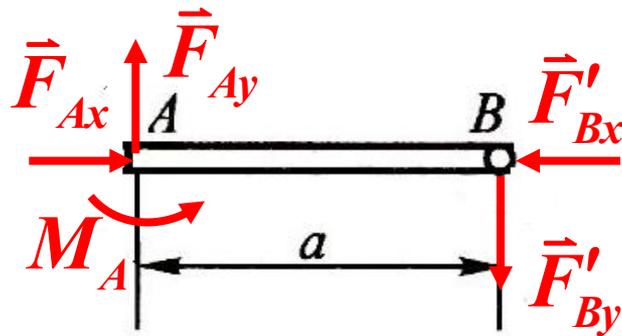
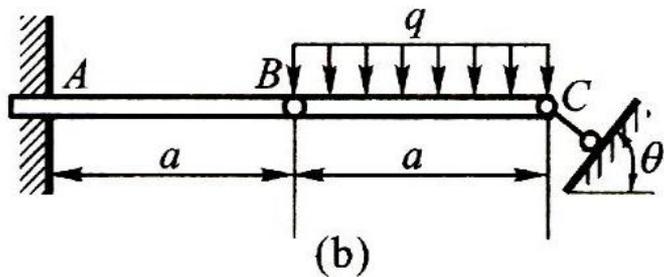
二、平面任意力系-习题2

求各梁在A、B、C处的约束反力。

解：(2) 取AB构件：

$$F_{Bx} = qa \tan \theta / 2$$

$$\sum F_x = 0 \quad F_{Ax} - F'_{Bx} = 0 \quad F_{Ax} = qa \tan \theta / 2$$



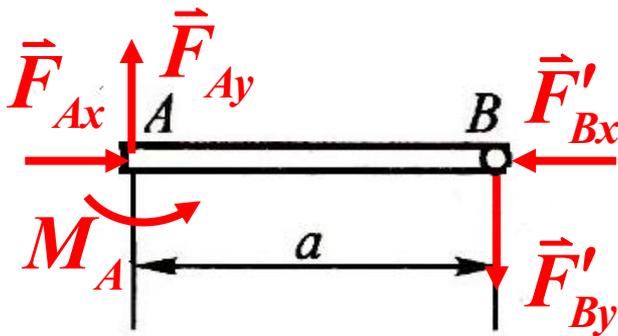
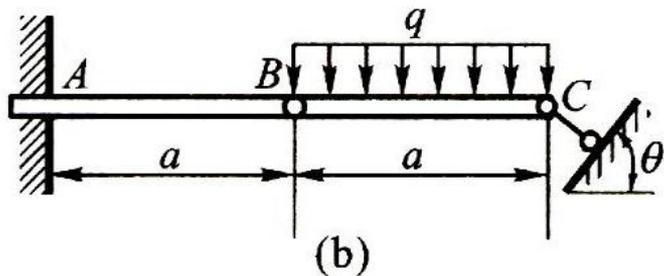
二、平面任意力系-习题2

求各梁在A、B、C处的约束反力。

解：(2) 取AB构件：

$$F_{By} = qa/2$$

$$\sum F_y = 0 \quad F_{Ay} - F'_{By} = 0 \quad F_{Ay} = qa/2$$



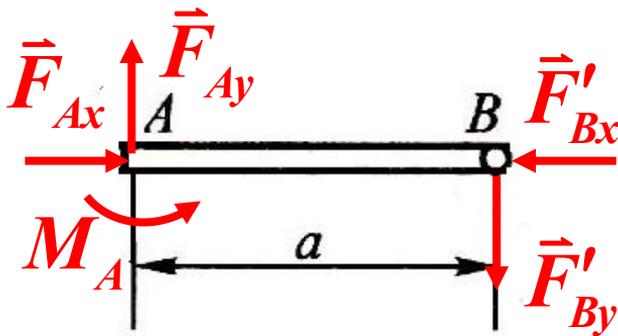
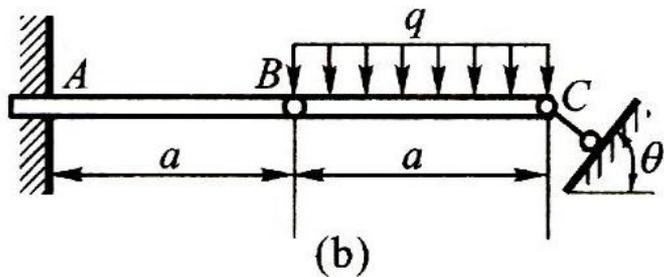
二、平面任意力系-习题2

求各梁在A、B、C处的约束反力。

解：(2) 取AB构件：

$$F_{By} = qa/2$$

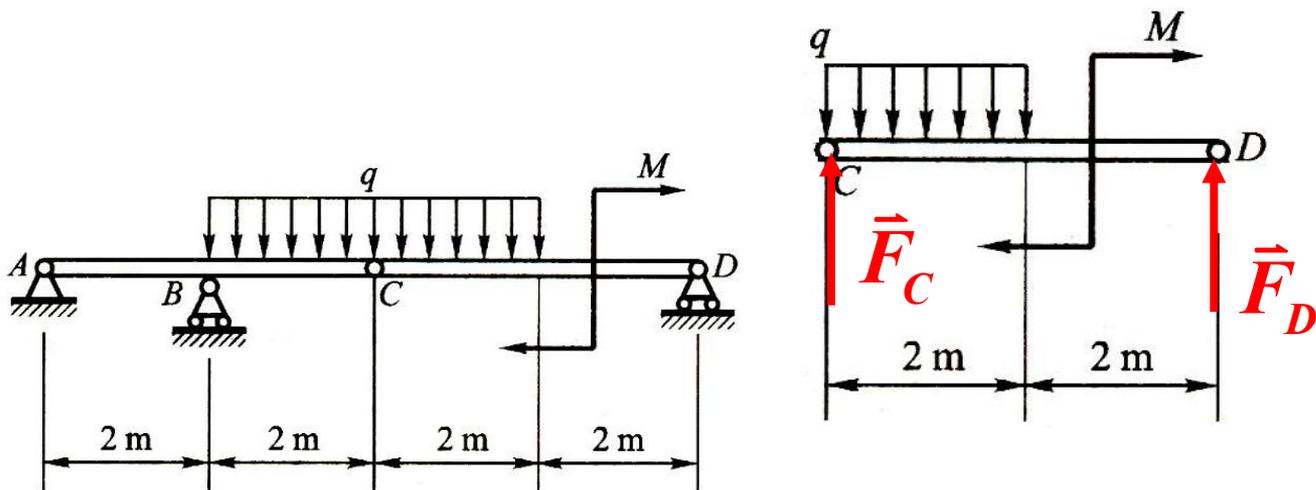
$$\sum M_A = 0 \quad M_A - F'_{By}a = 0 \quad M_A = qa^2/2$$



三、平面任意力系-习题3

求各约束反力。 $q = 10\text{kN/m}$, $M = 40\text{kN}\cdot\text{m}$

解：(1) 取CD构件：

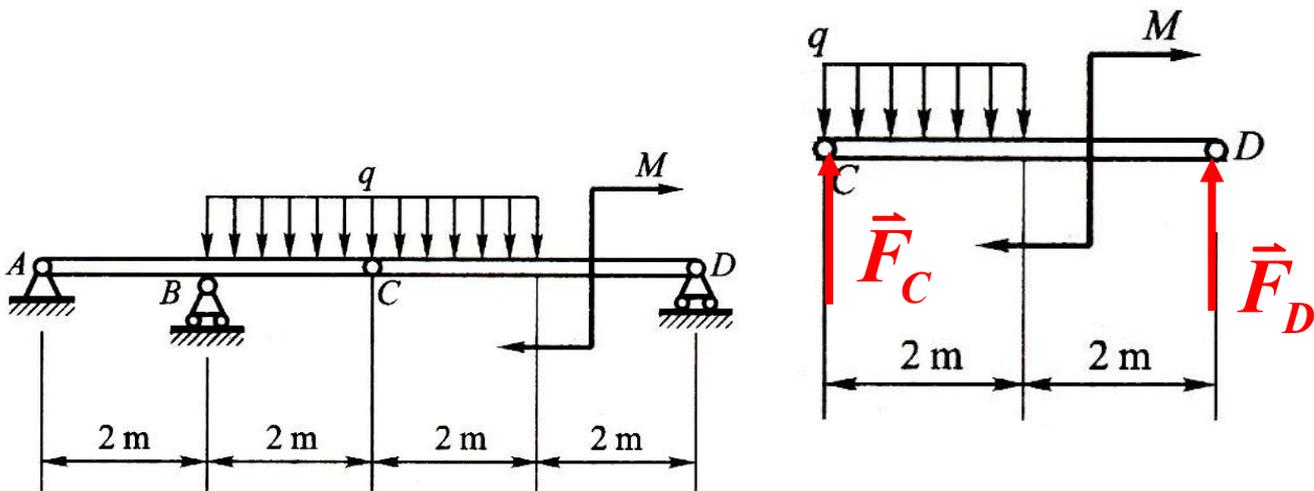


三、平面任意力系-习题3

解：(1) 取CD构件：

$$\sum M_C = 0 \quad -q \cdot 2^2 / 2 - M + F_D \cdot 4 = 0 \quad F_D = 15 \text{ kN}$$

$$\sum F_y = 0 \quad F_C + F_D - 2q = 0 \quad F_C = 5 \text{ kN}$$



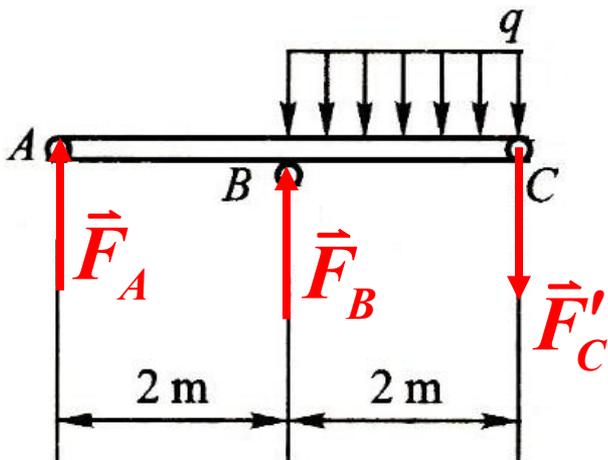
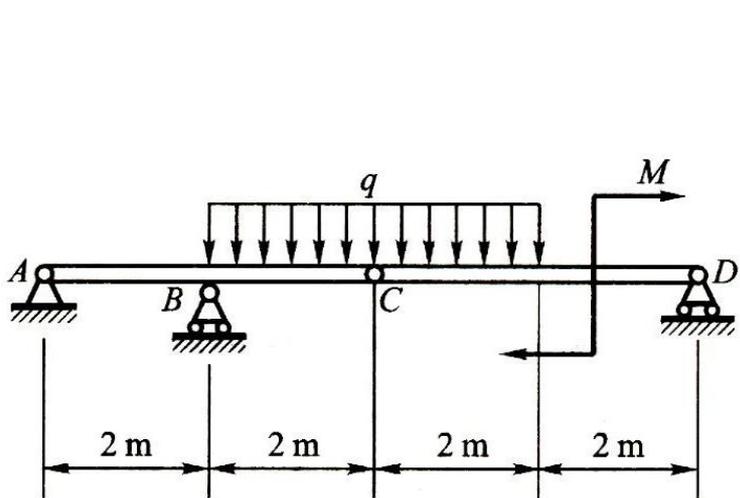
三、平面任意力系-习题3

解：(2) 取AC构件：

$$F_C = 5\text{kN}$$

$$\sum M_A = 0 \quad F_B \cdot 2 - F'_C \cdot 4 - 2q \cdot 3 = 0 \quad F_B = 40\text{kN}$$

$$\sum F_y = 0 \quad -F'_C + F_A + F_B - 2q = 0 \quad F_A = -15\text{kN}$$





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谢谢大家！