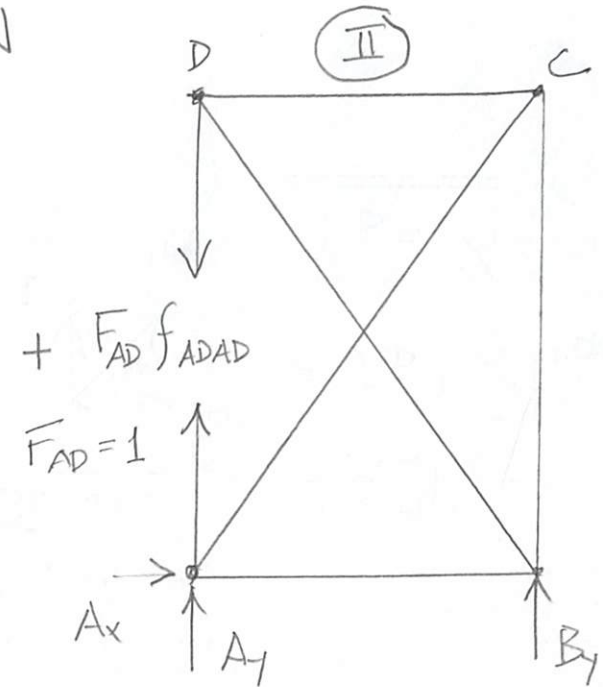
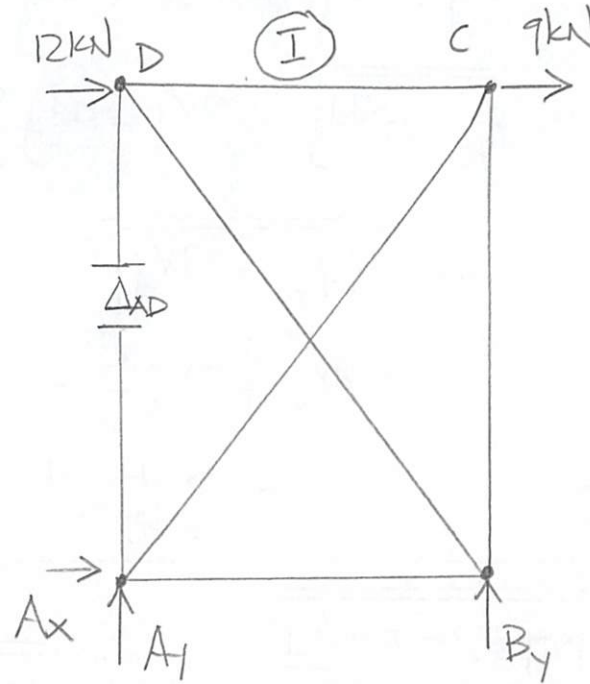
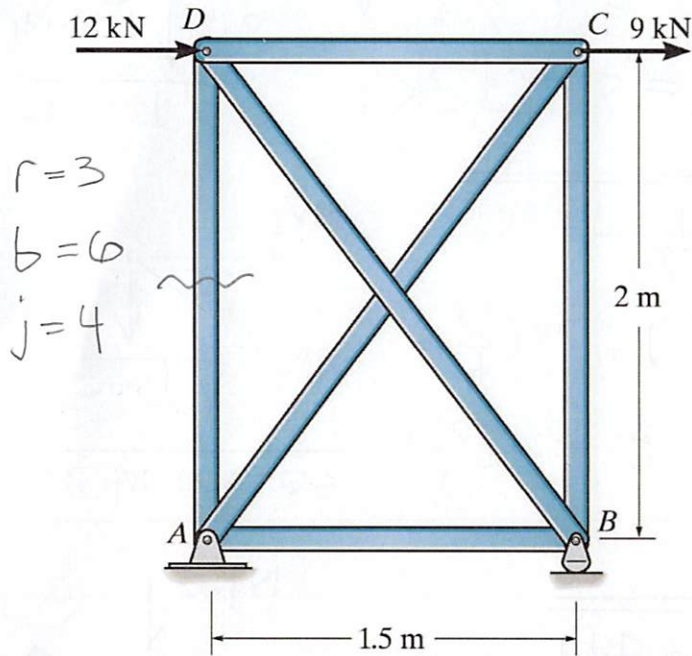


Problem 9c-1 – Determine the force in member AD. Assume AE is constant.



① $\sum M_A = 0 = B_y(1.5\text{ m}) - 12\text{ kN}(2\text{ m}) - 9\text{ kN}(2\text{ m})$ $B_y = 28\text{ kN}$

$+\uparrow \sum F_y = 0 = A_y + B_y$ $A_y = -28\text{ kN}$

$+\rightarrow \sum F_x = 0 = A_x + 12\text{ kN} + 9\text{ kN}$ $A_x = -21\text{ kN}$

② $\sum M_A = 0 = B_y(1.5\text{ m})$ $B_y = 0$

$+\uparrow \sum F_y = 0 = A_y + B_y - 1 + 1$ $A_y = 0$

$+\rightarrow \sum F_x = 0 = A_x$

$\Delta_{AD} + F_{AD} f_{ADAD} = 0$

Problem 9c-1 – Determine the force in member AD. Assume AE is constant.

Find the displacement in member AC. REAL FORCES

JOINT A

$$+\uparrow \sum F_y = 0 = \frac{4}{5} F_{AC} - 28 \text{ kN}$$

$$\underline{F_{AC} = 35 \text{ kN}}$$

$$+\rightarrow \sum F_x = 0 = \frac{3}{5} F_{AC} + F_{AB} - 21 \text{ kN}$$

$$\underline{F_{AB} = 0}$$

JOINT D

$$+\rightarrow \sum F_x = 0 = F_{CD} + 12 \text{ kN}$$

$$\underline{F_{CD} = -12 \text{ kN}}$$

JOINT B

$$+\rightarrow \sum F_x = 0 = \frac{3}{5} F_{BD}$$

$$\underline{F_{BD} = 0}$$

$$+\uparrow \sum F_y = 0 = F_{BC} + 28 \text{ kN}$$

$$\underline{F_{BC} = -28 \text{ kN}}$$

VIRTUAL FORCES

JOINT A

$$+\uparrow \sum F_y = 0 = \frac{4}{5} f_{AC} + 1$$

$$\underline{f_{AC} = -5/4}$$

$$+\rightarrow \sum F_x = 0 = \frac{3}{5} f_{AC} + f_{AB}$$

$$\underline{f_{AB} = 3/4}$$

JOINT D

$$+\rightarrow \sum F_x = 0 = f_{CD} + \frac{3}{5} f_{BD}$$

$$\underline{f_{CD} = 3/4}$$

JOINT B

$$+\rightarrow \sum F_x = 0 = -\frac{3}{5} f_{BD} - f_{AB}$$

$$\underline{f_{BD} = -5/4}$$

$$+\uparrow \sum F_y = 0 = \frac{4}{5} f_{BD} + f_{BC}$$

$$\underline{f_{BC} = 1}$$

Problem 9c-1 – Determine the force in member AD. Assume AE is constant.

Find the displacement in member AC due to force F_{AD} .

$$\Delta = \sum \frac{FfL}{AE}$$

MEMBER	F(kN)	f	L(m)	FfL (kNm)	ffL(m)
AB	0	3/4	1.5	0	0.8438
BC	-28	1	2	-56	2
CD	-12	3/4	1.5	-13.5	0.8438
DB	0	-5/4	2.5	0	3.9063
AC	35	-5/4	2.5	-109.375	3.9063
AD	0	1	2	0	2
Σ				-178.875	13.5

$$\Delta_{AD} + F_{AD} f_{ADAD} = 0 = -178.875 \text{ kNm} + F_{AD} (13.5 \text{ m}) \quad \underline{\underline{F_{AD} = 13.25 \text{ kN}}}$$