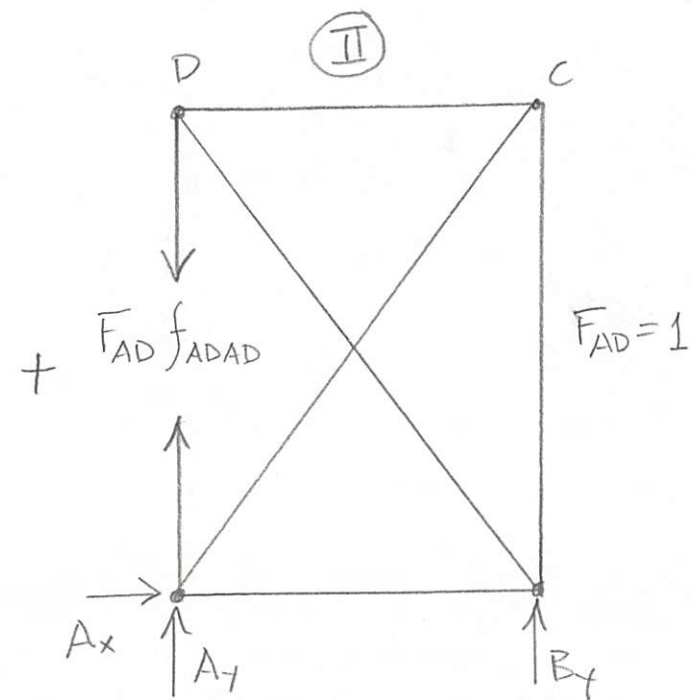
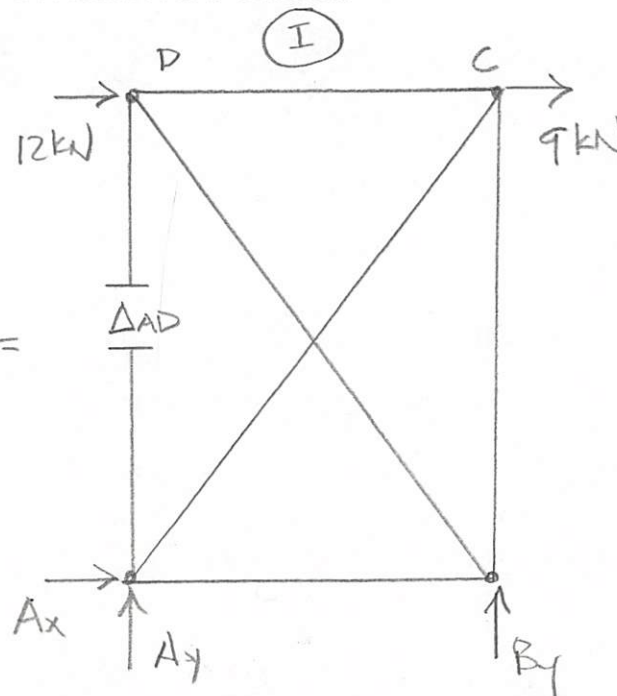
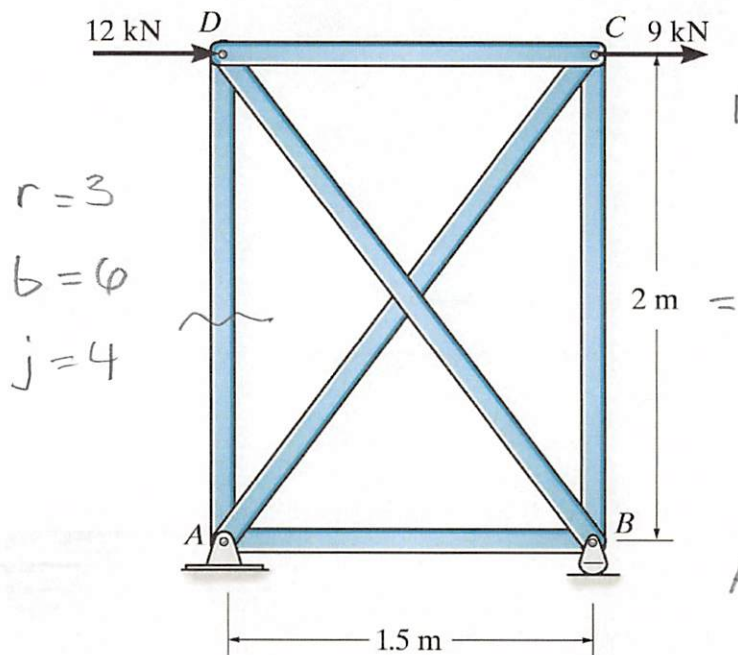


Problem 9c-1 – Determine the force in member AD. Assume AE is constant.

1/3



(I) $\sum M_A = 0 = -12 \text{ kN}(2 \text{ m}) - 9 \text{ kN}(2 \text{ m}) + B_y(1.5 \text{ m})$
 $\uparrow \sum F_y = 0 = A_y + B_y$ $A_y = -28 \text{ kN}$
 $\rightarrow \sum F_x = 0 = A_x + 12 \text{ kN} + 9 \text{ kN}$ $A_x = -21 \text{ kN}$

$B_y = 28 \text{ kN}$

(II) $\sum M_A = 0 = B_y(1.5 \text{ m})$ $B_y = 0$
 $\uparrow \sum F_y = 0 = A_y + B_y - 1 + 1$ $A_y = 0$
 $\rightarrow \sum F_x = 0 = A_x$

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

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

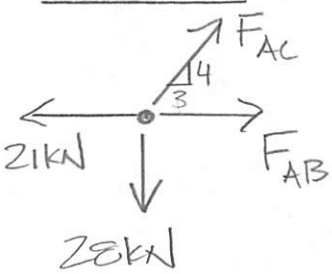
2/3

Find the displacement in member AC.

REAL FORCES

Δ_{AD}

JOINT A



$$+\uparrow \sum F_y = 0$$

$$= \frac{4}{5} F_{AC} - 2 \text{ kN}$$

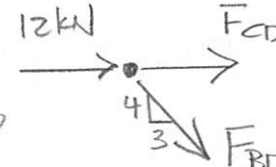
$$\underline{F_{AC} = 35 \text{ kN}}$$

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

$$= F_{AB} + \frac{3}{5} F_{AC} - 2 \text{ kN}$$

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

JOINT D



$$+\uparrow \sum F_y = 0 = -\frac{4}{5} F_{BD}$$

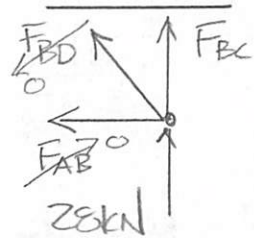
$$\underline{F_{BD} = 0}$$

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

$$= 12 \text{ kN} + F_{CD}$$

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

JOINT B

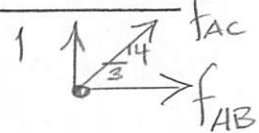


$$+\uparrow \sum F_y = 0 = F_{BC} + 2 \text{ kN}$$

$$\underline{F_{BC} = -2 \text{ kN}}$$

VIRTUAL FORCES

JOINT A



$$+\uparrow \sum F_y = 0$$

$$= \frac{4}{5} f_{AC} + 1$$

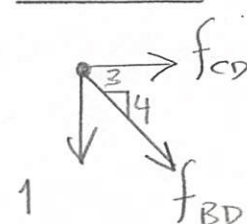
$$\underline{f_{AC} = -1.25}$$

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

$$= f_{AB} + \frac{3}{5} f_{AC}$$

$$\underline{f_{AB} = 0.75}$$

JOINT D



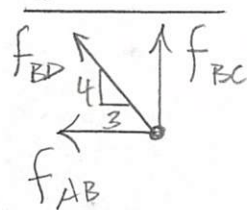
$$+\uparrow \sum F_y = 0 = -\frac{4}{5} f_{BD} - 1$$

$$\underline{f_{BD} = -1.25}$$

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

$$\underline{f_{CD} = 0.75}$$

JOINT B



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

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

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

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

3/3

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

MEMBER	F(kN)	f	L(m)	FfL (kNm)	f_{ADAD} ffL (m)
AB	0	0.75	1.5	0	0.8438
BC	-28	1	2	-56	2
CD	-12	0.75	1.5	-13.5	0.8438
DB	0	-1.25	2.5	0	3.9063
AC	35	-1.25	2.5	-109.375	3.9063
AD	0	1	2	0	2
$\sum$				-178.875	13.5

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

$$F_{AD} = \frac{178.875 \text{ kNm}}{13.5 \text{ m}} = \underline{\underline{13.25 \text{ kN}}}$$

$$-178.875 \text{ kNm} + F_{AD} (13.5 \text{ m}) = 0$$