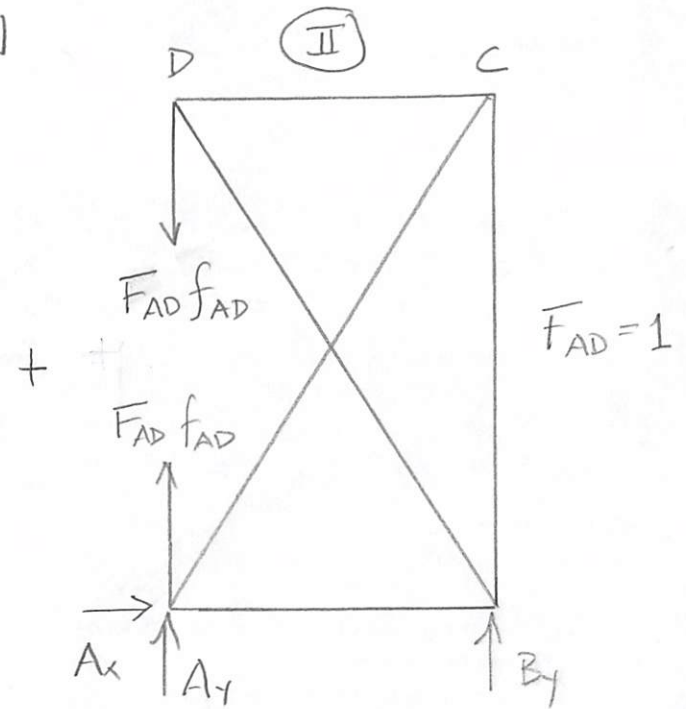
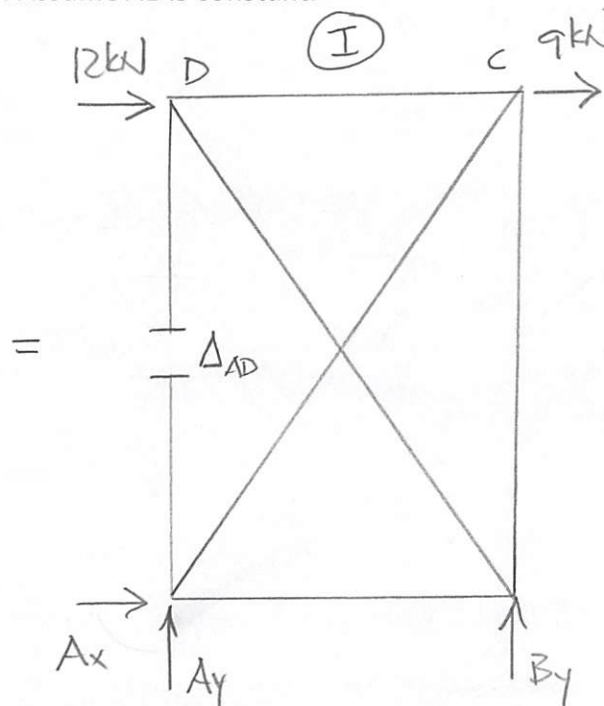
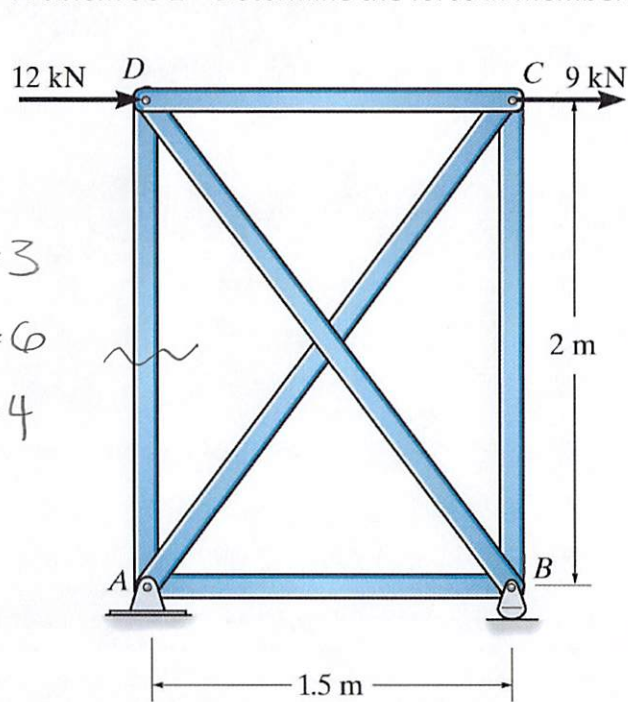


Problem 9c-1 – Determine the force in member AD. Assume AE is constant.



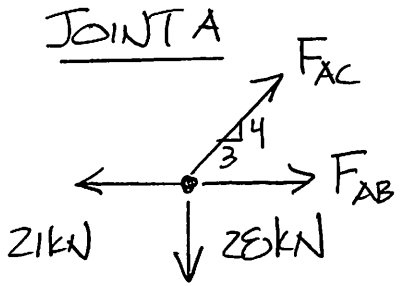
$$\textcircled{I} \quad \begin{aligned} \sum M_A = 0 &= -12 \text{ kN}(2 \text{ m}) - 9 \text{ kN}(2 \text{ m}) + B_y(1.5 \text{ m}) & B_y &= 28 \text{ kN} \\ \sum F_y = 0 &= A_y + B_y & A_y &= -28 \text{ kN} \\ \sum F_x = 0 &= A_x + 12 \text{ kN} + 9 \text{ kN} & A_x &= -21 \text{ kN} \end{aligned}$$

$$\textcircled{II} \quad \begin{aligned} \sum M_A = 0 &= B_y(1.5 \text{ m}) & B_y &= 0 \\ \sum F_y = 0 &= A_y + B_y + 1 - 1 & A_y &= 0 \\ \sum F_x = 0 &= A_x \end{aligned}$$

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

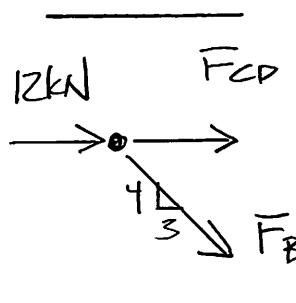
Find displacement in member AC. REAL FORCES

JOINT A



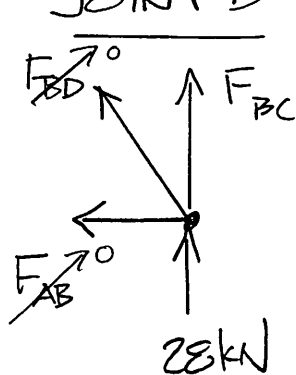
$$\begin{aligned}
 +\uparrow \sum F_y &= 0: & \rightarrow \sum F_x &= 0 \\
 &= \frac{4}{5} F_{AC} - 28 \text{ kN} & &= F_{AB} + \frac{3}{5} F_{AC} - 21 \text{ kN} \\
 \underline{F_{AC} = 35 \text{ kN}} & & \underline{F_{AB} = 0}
 \end{aligned}$$

JOINT D



$$\begin{aligned}
 +\uparrow \sum F_y &= 0 & \rightarrow \sum F_x &= 0 \\
 &= \frac{4}{5} F_{BD} & &= F_{CD} + 12 \text{ kN} \\
 \underline{F_{BD} = 0} & & \underline{F_{CD} = -12 \text{ kN}}
 \end{aligned}$$

JOINT B

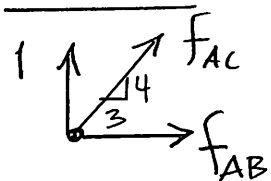


$$\begin{aligned}
 +\uparrow \sum F_y &= 0 \\
 &= F_{BC} + 28 \text{ kN} \\
 \underline{F_{BC} = -28 \text{ kN}}
 \end{aligned}$$

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

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

JOINT A



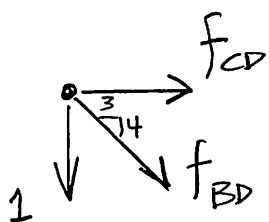
$$\begin{aligned}
 +\uparrow \sum F_y &= 0 \\
 &= \frac{4}{5} f_{AC} + 1 \\
 \underline{f_{AC} &= -1.25}
 \end{aligned}$$

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

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

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

JOINT D



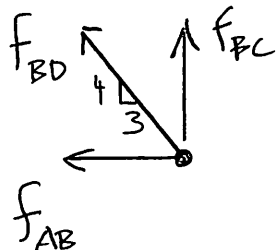
$$\begin{aligned}
 +\uparrow \sum F_y &= 0 \\
 &= -\frac{4}{5} f_{BD} - 1 \\
 \underline{f_{BD} &= -1.25}
 \end{aligned}$$

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

$$= f_{CD} + \frac{3}{5} f_{BD}$$

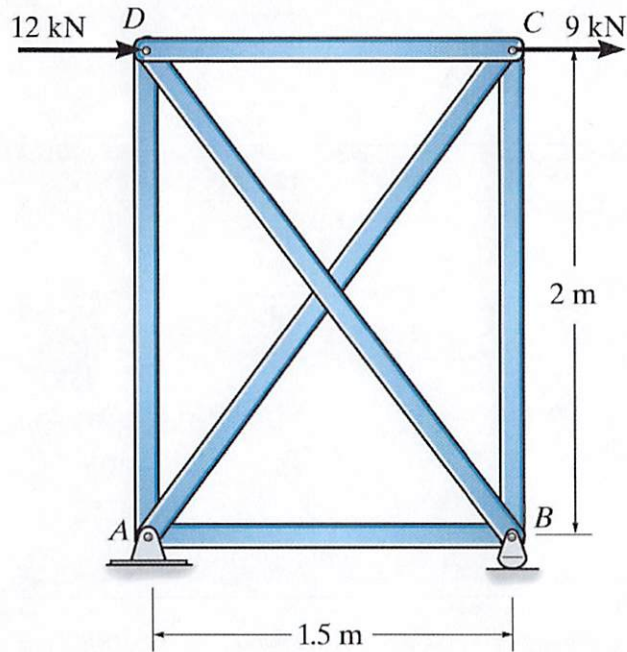
$$\underline{f_{CD} = 0.75}$$

JOINT B



$$\begin{aligned}
 +\uparrow \sum F_y &= 0 \\
 &= f_{BC} + \frac{4}{5} f_{BD} \\
 \underline{f_{BC} &= 1}
 \end{aligned}$$

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



MEMBER	F(kN)	f	L(m)	FfL(kNm)	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
				-178.875	13.5

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