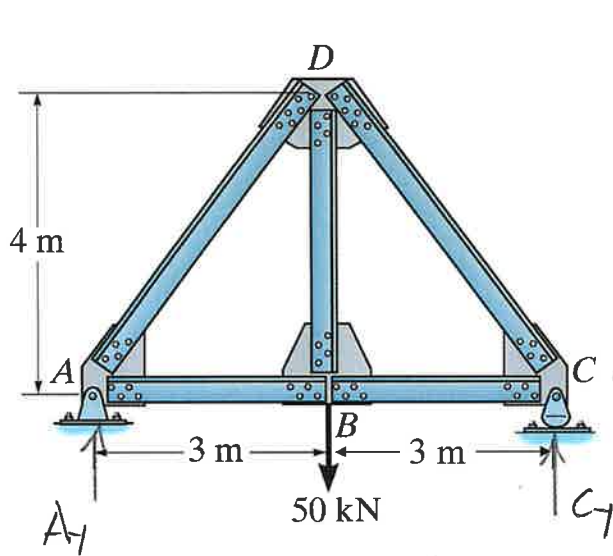


Example 8a-1: Determine the vertical displacement of joint *D*. Assume *AE* is constant.



$$\begin{aligned} \sum M_C = 0 &= 50 \text{ kN}(3 \text{ m}) - A_y(6 \text{ m}) & \underline{A_y = 25 \text{ kN}} \\ \sum F_y = 0 &= A_y + C_y - 50 \text{ kN} & \underline{C_y = 25 \text{ kN}} \end{aligned}$$

JOINT A

$$\begin{aligned} \sum F_y = 0 & \\ &= \frac{4}{5} F_{AD} + 25 \text{ kN} \\ & \underline{F_{AD} = -31.25 \text{ kN}} \\ \sum F_x = 0 & \\ &= \frac{3}{5} F_{AD} + F_{AB} \\ & \underline{F_{AB} = 18.75 \text{ kN}} \end{aligned}$$

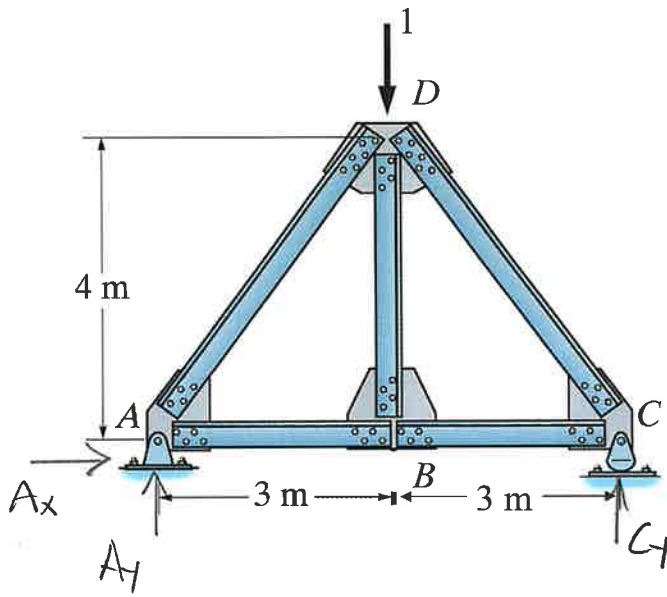
JOINT C

$$\begin{aligned} \sum F_y = 0 & \\ &= \frac{4}{5} F_{CD} + 25 \text{ kN} \\ & \underline{F_{CD} = -31.25 \text{ kN}} \\ \sum F_x = 0 & \\ &= -\frac{3}{5} F_{CD} - F_{BC} \\ & \underline{F_{BC} = 18.75 \text{ kN}} \end{aligned}$$

JOINT B

$$\begin{aligned} \sum F_y = 0 &= F_{BD} - 50 \text{ kN} \\ & \underline{F_{BD} = 50 \text{ kN}} \end{aligned}$$

Example 8a-1: Determine the vertical displacement of joint D . Assume AE is constant.



$$\curvearrowleft \sum M_C = 0 = 1(3\text{m}) - A_y(6\text{m})$$

$$\underline{A_y = 1/2}$$

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

$$\underline{C_y = 1/2}$$

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

JOINT A

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

$$= \frac{4}{5}f_{AD} + \frac{1}{2}$$

$$\underline{f_{AD} = -0.625}$$

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

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

$$\underline{f_{AB} = 0.375}$$

JOINT C

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

$$= \frac{4}{5}f_{CD} + \frac{1}{2}$$

$$\underline{f_{CD} = -0.625}$$

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

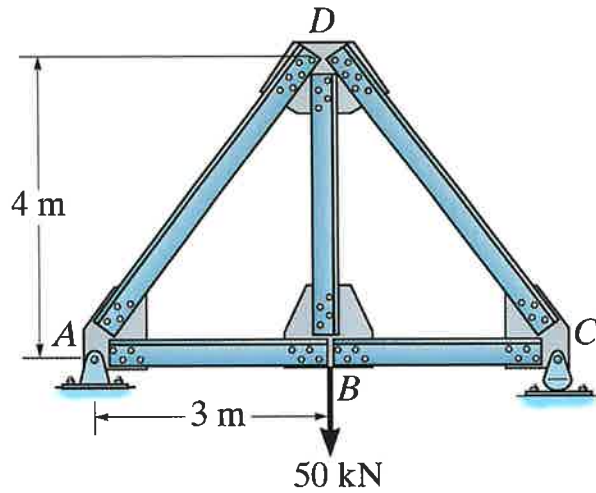
$$= -\frac{3}{5}f_{CD} - f_{BC}$$

$$\underline{f_{BC} = 0.375}$$

JOINT B

$$+\uparrow \sum F_y = 0 = f_{BD}$$

Example 8a-1: Determine the vertical displacement of joint *D*. Assume *AE* is constant.



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

Element	<i>F</i> (kN)	<i>f</i>	<i>L</i> (m)	<i>FfL</i>
AB	18.75	0.375	3	21.094
AD	-31.25	-0.625	5	97.656
BC	18.75	0.375	3	21.094
CD	-31.25	-0.625	5	97.656
BD	50	0	4	0

$$\sum \frac{237.5 \text{ kNm}}{AE}$$

$$AE = L^2 \frac{F}{L^2} = F$$