M R

Ahmed Mahdy

فيزياء	استاتيكا
دوائر كهربية	الكـــترونيات
ميكانيكا الانشائات	هيدروليكا

مدرس خصوصي

اونلاين حضوري

يحصل الطالب علي

- مقاطع فيديوهات لشرح المقرر بشكل وافي
- ملخص للمادة Pdf للمذكرة والمراجعة
- محاضرات مباشرة علي برنامج زووم
- لمناقشة الأجزاء الغير مفهومة
- تواصل مستمر مع معلم المادة

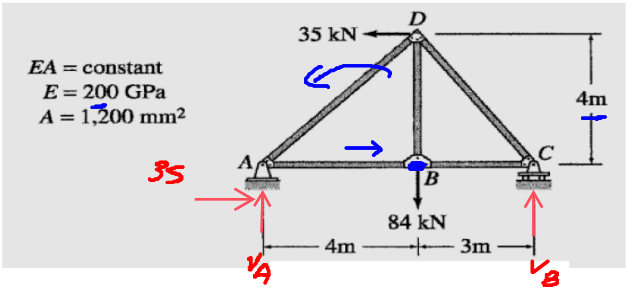
للتواصل

0567630097

0565657741

Example No (2)

Determine the horizontal and vertical components of the deflection at joint B of the truss shown in Fig. below by the virtual work method.



$(mm)^2 \rightarrow (10^{-3}\,m)^2$

$EA = 200 \times 10^6 \times 1200 \times 10^{-6}$

$\Sigma M_A = 84 \times 4 - V_B \times 7 - 35 \times 4 = 0$

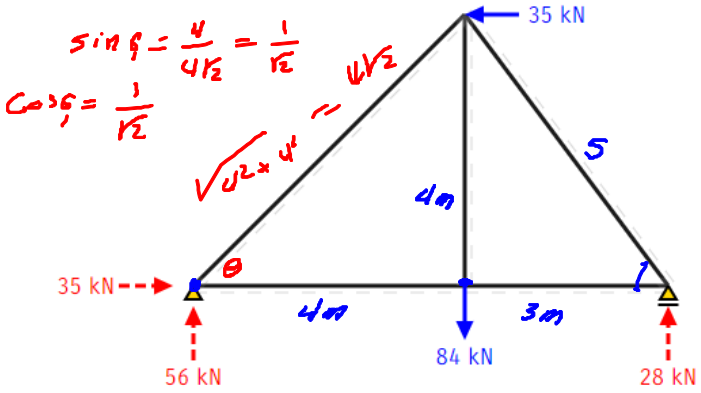
$V_B = 28\ kN$

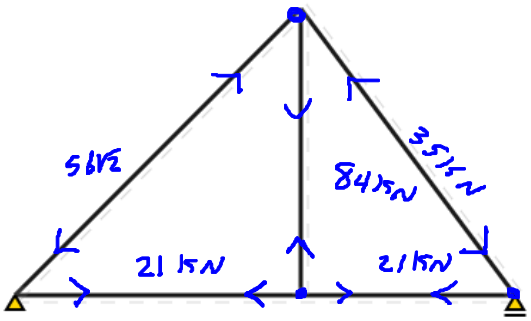
$\Sigma F_y = V_A - 84 + 28 = 0$

$V_A = 56\ kN$

$\sin\theta_2 = \frac{4}{5} = 0.8$

$\cos\theta_2 = \frac{3}{5} = 0.6$

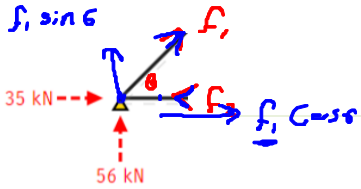




$\sin\theta = \frac{4}{4\sqrt{2}} = \frac{1}{\sqrt{2}}$

$\cos\theta = \frac{1}{\sqrt{2}}$

$\sqrt{4^2+4^2} = 4\sqrt{2}$

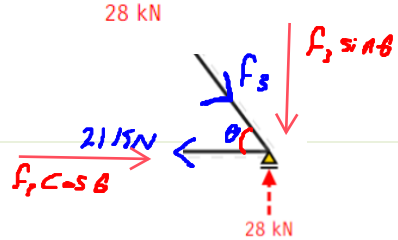


$\Sigma F_y = f_1 \times \frac{1}{\sqrt{2}} + 56 = 0$

$f_1 = -56\sqrt{2}$

$\Sigma F_x = 35 - f_2 + (-56\sqrt{2}) \cdot \frac{1}{\sqrt{2}} = 0$

$f_2 = -21\ kN$



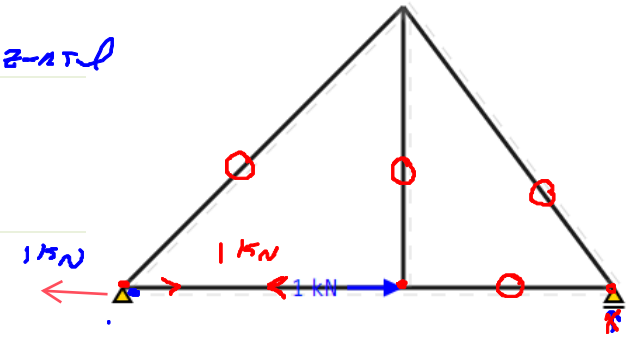
$\Sigma F_x = f_3 \times 0.6 - 21 = 0$

$f_3 = 35\ kN$

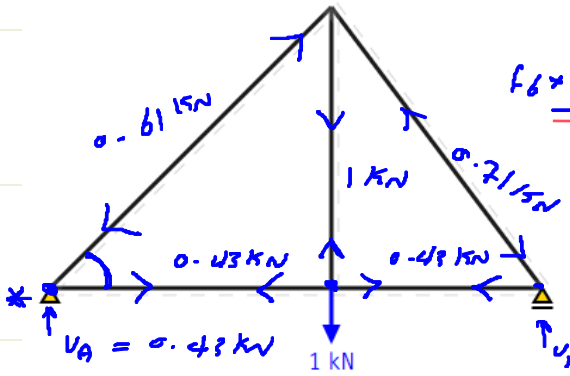
$\Sigma F_y = 28 - 35 \times 0.8$

$F_y = 0\ kN$

horizontal



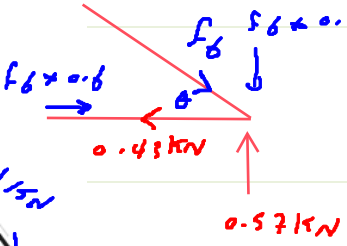
vertical



$V_A = 0.43\,kN$ $\quad V_B = 0.57\,kN$

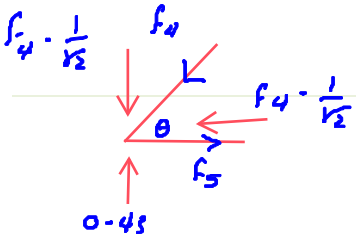
$\Sigma M_A = 1 \times 4 - V_B \times 7 = 0$

$V_B = 0.57\,kN$



$\Sigma F_x = f_6 \times \frac{0.6}{0.1} = \frac{0.43}{0.6}$

$f_6 = 0.71\,kN$

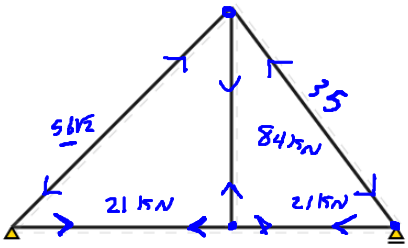


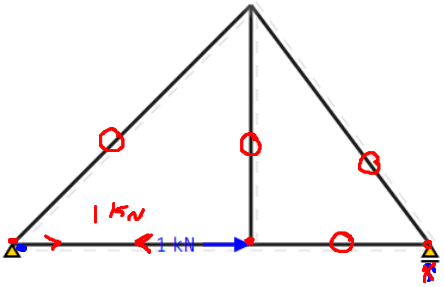
$\Sigma F_y = 0.43 - f_4 \times \frac{1}{\sqrt{2}} = 0$

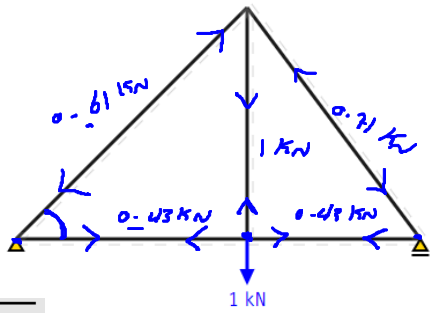
$f_4 = 0.61\,kN$

$\Sigma F_x = f_5 - 0.61 \times \frac{1}{\sqrt{2}} = 0$

$f_5 = 0.43\,kN$

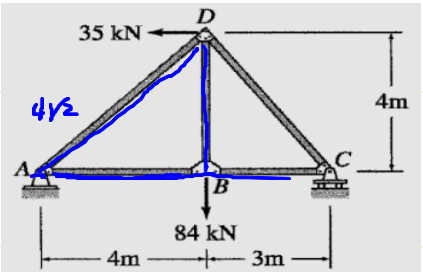






TABLE

Member	L (m)	F_v (kN)	F_{v1} (kN)	$F_{v1}(FL)$ (kN^2–m)	F_{v2} (kN)	$F_{v2}(FL)$ (kN^2–m)
AB	4	21	1	84	0.43	36.12
BC	3	21	0	0	0.43	27.09
AD	5.66	−79.2	0	0	−0.61	273.45
BD	4	84	0	0	1	336.00
CD	5	−35	0	0	−0.71	124.25
		$\sum F_v(FL)$		84		796.91



Step 4: Calculate the horizontal deflection

$$1(\Delta_{BH}) = \frac{1}{EA}\sum F_{v1}(FL)$$

$$(1\text{ kN})\Delta_{BH} = \frac{84}{200(10^6)(0.0012)}\frac{\text{kN}\cdot\text{m}}{\text{kN–m}}$$

$$\Delta_{BH} = 0.00035\text{ m}$$

$$\Delta_{BH} = 0.35\text{ mm} \rightarrow \quad \text{Ans.}$$

Step 5: Calculate the vertical deflection

$$1(\Delta_{BV}) = \frac{1}{EA}\sum F_{v2}(FL)$$

$$(1\text{ kN})\Delta_{BV} = \frac{796.91}{200(10^6)(0.0012)}\frac{\text{kN}\cdot\text{m}}{\text{kN–m}}$$

$$\Delta_{BV} = 0.00332\text{ m}$$

$$\Delta_{BV} = 3.32\text{ mm} \downarrow \quad \text{Ans.}$$