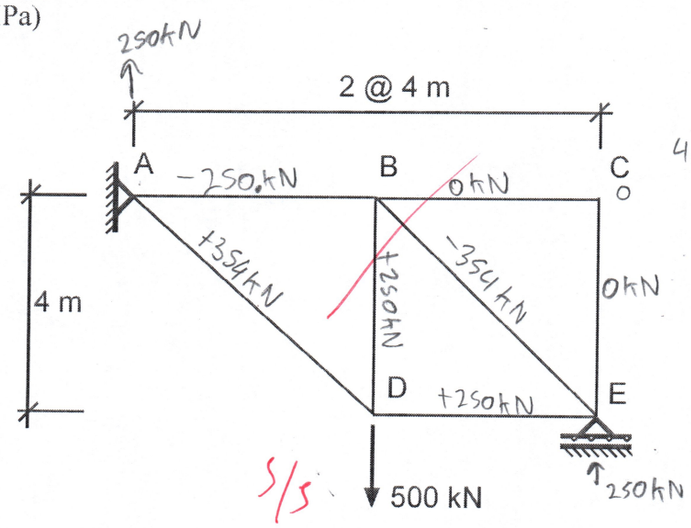
10/10

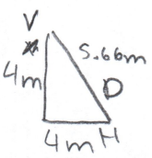
Name: Leong (last) David (first)

CIV102F: Quiz #8 1300h-1500h Thursday October 31, 2019

Deflection of Trusses

Members AD and BE in the truss below each have a cross-sectional area of 1100 mm^2 and the other members have a cross-sectional area of 900 mm^2. Calculate the forces in all truss members, and determine the *horizontal* displacement of joint E. Use the method of virtual work. Ignore the truss self-weight. (E = 200,000 MPa)





$\frac{H}{V} = \frac{4}{4}$ $\therefore H = V$

$\frac{D}{V} = \frac{5.66}{4\,m}$

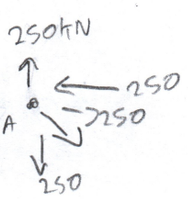
$\therefore D = \frac{5.66}{4} V$

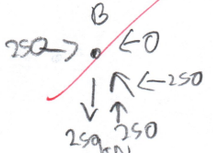
5/5

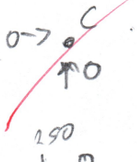
$\Sigma F_x = 0$

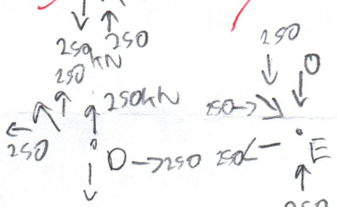
$\Sigma F_y = 0$

$\Sigma M = 0$









$\Sigma F_x = 0 = A_x$

$\Sigma M_E = 0 = (8\,A_y) - 4 \times 500kN$

$\therefore A_y = 250kN$

$\Sigma F_y = 0 = A_y + E_y - 500kN$

$E_y = 250kN$

Member	F [kN]	ΔL [mm]	F* [kN]	W [kN·mm]	L
AB	-250.0	-5.56	-0.500	2.78	4
AD	+354	9.11mm	-0.707	-6.44	5.66
BC	0	0	0		4
BE	-354	-9.11	-0.707	6.44	5.66
BD	+250	5.56	+0.5	2.78	4
DE	+250	5.56	-0.5	-2.78	4
CE	0	0	0		4
		+1		+1	

$\Delta L_{AD} = \frac{(354000N)(5660mm)}{1100mm^2 \cdot 200000MPa}$

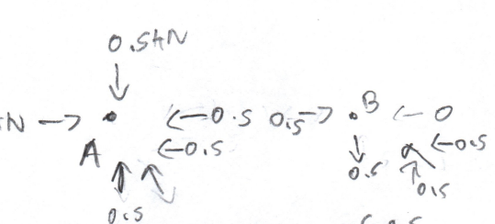
Sum = 2.78kN·mm $\Rightarrow$ $W = P \cdot d$

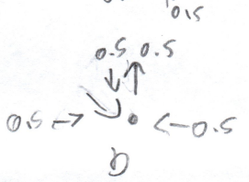
2.78kN·mm = 1kN·d

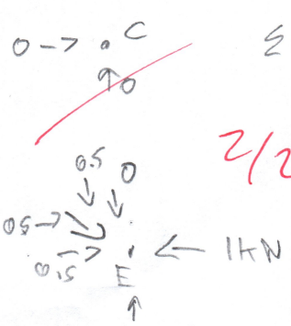
$\therefore$ 2.78mm = d

$\Rightarrow$ E is displaced 2.78mm →

+1







2/2

$\Sigma F_x = 0 \therefore A_x = 1kN$

$\Sigma M = 0 = 4 \cdot 1kN - 8 \cdot E_y$

$E_y = \frac{1}{2} 1kN = 0.5kN$

$\Sigma F_y = 0 \therefore A_y = 0.5kN$