MIDTERM / ENCE 3341

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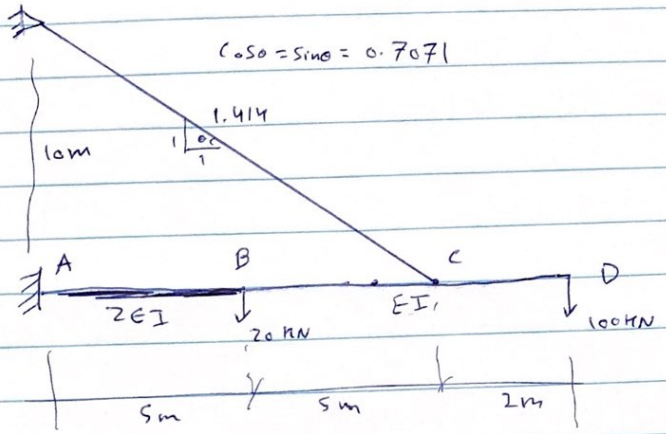
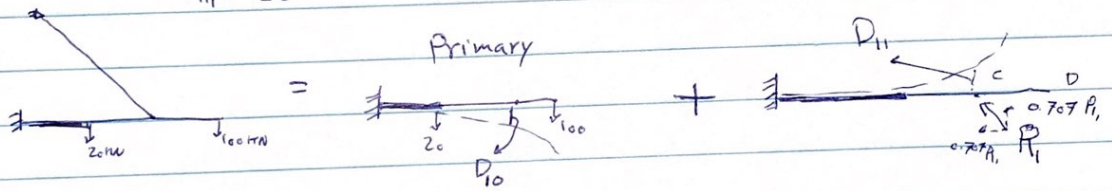


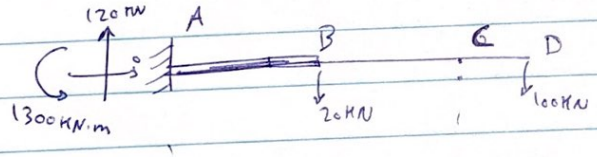
$R_1 = F_{CE}$

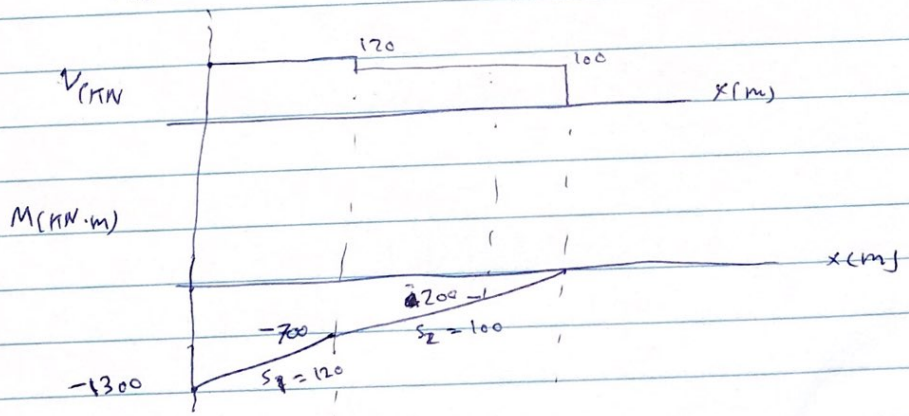


Comp. eq.s :

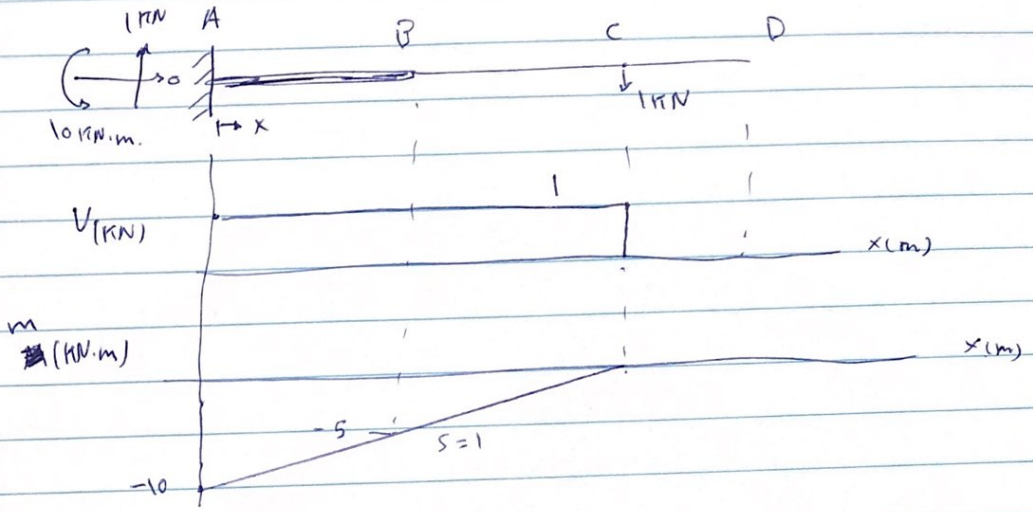
vertical def. at C : elong. $= D_{10} + D_{11} = D_{10} + R_1 \, d_{11} \, (0.707)$

To find D_{10} :





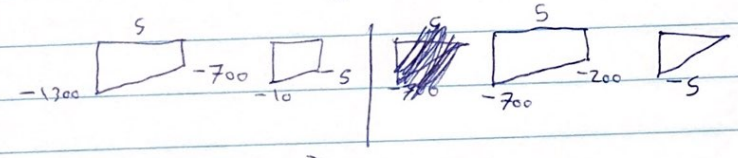
Virtual Primary ∘



Virtual work method to find D_{10} ∘

$$1.\ \Delta C_{\text{in Primary System}} = 1 \cdot D_{10} = \int_0^5 \frac{M m \cdot dx}{2EI} + \int_5^{10} \frac{M m \cdot dx}{EI} + \int_{10}^{12} \frac{M m \cdot dx}{EI} \cdot dx$$

0 ≤ m ≤ 10 < x < 12.



$$D_{10} = \frac{1}{2EI}\left[\frac{5}{6}\left(-10\left(2(-1300)-700\right) - 5\left(-1300-(2)700\right)\right] + \frac{1}{EI}\left[\frac{5}{6}(-5)(-700-400)\right]\right.$$

$$= \frac{38750}{2EI} + \frac{4583.\bar{3}}{EI} = \frac{23958.\bar{3}}{EI} = 0.479166\ m.$$

to find d_{11} ∘

$$1 \cdot d_{11} = \int_0^5 \frac{m^2 \cdot dx}{2EI} + \int_5^{10} \frac{m^2 \cdot dx}{EI} + \int_{10}^{12} \frac{m^2 \cdot dx}{EI} \cdot dx$$

$$d_{11} = \frac{145.83}{EI} + \frac{41.\bar{6}}{EI} = \frac{187.5}{EI} = 0.00375\,m$$

elongation of CE :

$$L = \sqrt{10^2 + 10^2} = 14.14\ m$$

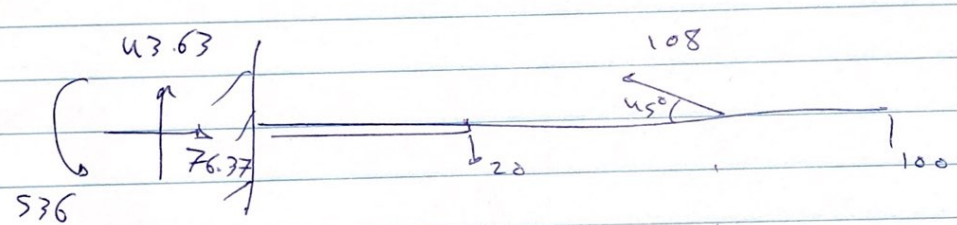
$$\delta = \frac{PL}{AE} = 1.2777\ m.$$

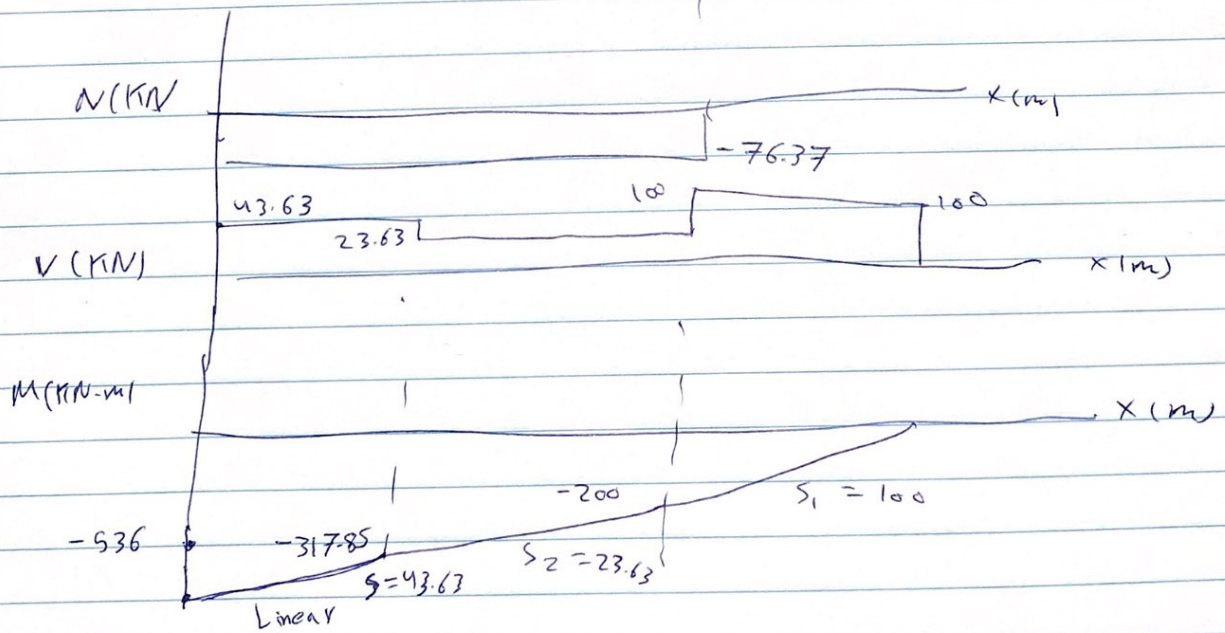
$$elong. = D_{10} + D_{11}$$

$$\frac{R_1 L}{AE} = 0.479160 + R_1 (0.7071)(0.00375$$

$$R_1 = 108.438\ KN = F_{CE}$$

$$elong. = 0.7666\ m$$





$$\Delta C = -0.7666\ m.$$