4.2

$$d\delta = \frac{N(x)\,dx}{A(x)\,E(x)}$$

$$\delta = \int_0^L d\delta$$

$$\delta_{ST} = \frac{N L_{ST}}{A_{ST} E_{ST}} = \frac{80\ \text{kN} \cdot 600\ \text{mm}}{\pi (5\ \text{mm})^2 \ 200\ \text{GPa}} = 3.06\ \text{mm}$$

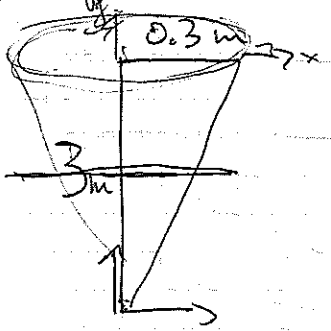
$$\delta_{AL} = \frac{N L_{AL}}{A_{AL} E_{AL}} = \frac{80\ \text{kN} \ \ 400\ \text{mm}}{400\ \text{mm}^2 \ \ 70\ \text{GPa}} = 1.14\ \text{mm}$$

$$\delta = 4.20\ \text{mm}$$

4.41

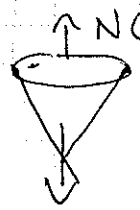
$$d\delta = \frac{N(y)\,dy}{A(y)\,E}$$

$$A = \pi r^2 = \pi \left(\frac{1}{10} y\right)^2 = \frac{\pi y^2}{100}$$



$$\frac{r}{y} = \frac{0.3}{3} \Rightarrow r = \frac{1}{10} y$$

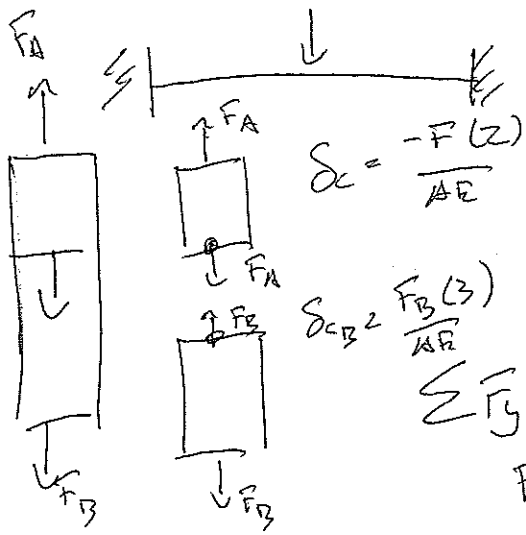
$\gamma = 6\ \text{kN/m}^3$



$$W = \gamma V = 6\ \text{kN/m}^3 \cdot \frac{1}{3} \frac{\pi y^2}{100} y$$

$$d\delta = \frac{6\ \text{kN/m}^3 \left(\frac{1}{3}\right)\left(\frac{\pi y^2}{100}\right) y}{\left(\frac{\pi y^2}{100}\right) 9\ \text{GPa}} = \int_0^{3\,\text{m}} \frac{2\ \text{kN}\ y\ \text{m}}{\text{m}^3\ 9\ \text{GPa} \times 10^6\ \text{kPa}} dy$$

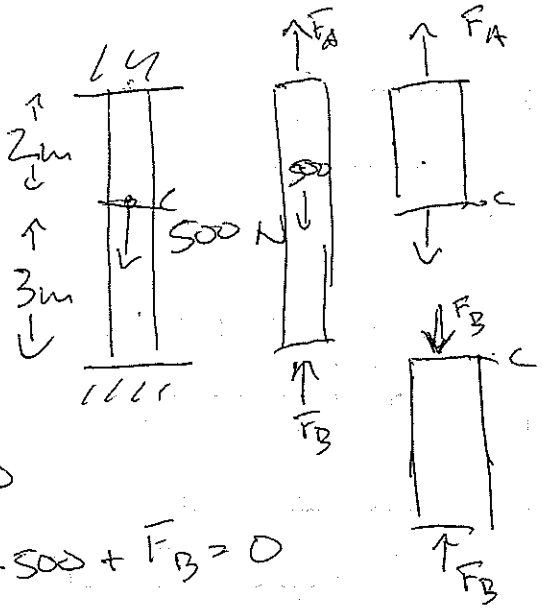
$$= \left[\frac{y^2}{9 \times 10^6} \right]_0^3 \text{m} = \boxed{1\ \mu\text{m}}$$



$$\delta_C = \frac{-F(2)}{AE}$$

$$\delta_{CB} = \frac{F_B(3)}{AE}$$

$$-\frac{2F_A}{AE} = \frac{3F_B}{AE}$$



$$\sum F_y = 0$$

$$F_A - 500 + F_B = 0$$

$$\frac{3}{2}F_B + F_B = 500\ N$$

$$\frac{5}{2}F_B = 500$$

$$\Rightarrow F_B = 200\ N$$

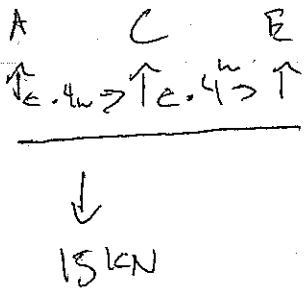
$$\frac{NL}{AE} \Rightarrow \frac{F_A(2)}{AE}$$

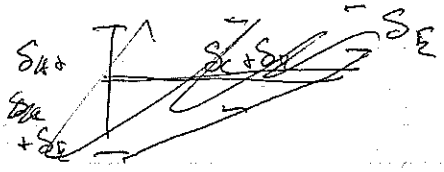
$$\delta_{CA} = \frac{2F_A}{AE}$$

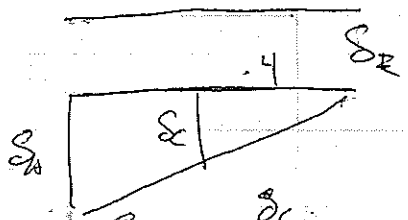
$$\delta_{CB} = \frac{F_B 3}{AE}$$

$$\frac{2F_A}{AE} = \frac{3F_B}{AE}$$

4.7







$$\frac{\delta_A}{.8} = \frac{\delta_C}{.4}$$

$$\delta_A = 2\delta_C$$

$$\sum F_y = 0$$

$$\frac{F_A L}{50 mm^2 E} = \frac{2F_C L}{30 mm^2 E}$$

$$\sum M_A = 0$$

$$F_A = \frac{100}{30} F_C$$