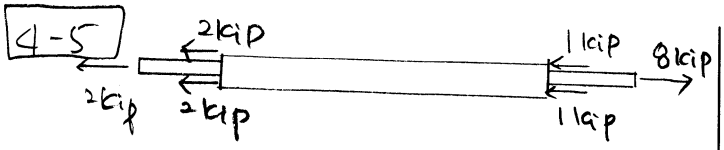
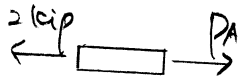
12-331 Solid Mechanics

HW #4 Due: 9/26/2000

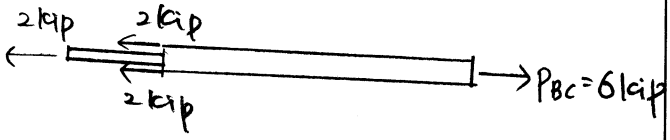
4-5



δ_{AB} ;



δ_{BC} ;

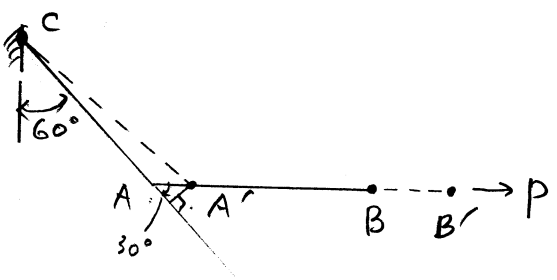


$$\delta_{AC} = \sum \frac{PL}{AE} = \delta_{AB} + \delta_{BC}$$

$$\delta_{AC} = \frac{2.0(4)(12)}{\frac{\pi}{4}(0.75^2)(15.0)(10^3)} + \frac{6.0(10)(12)}{\frac{\pi}{4}(2^2)(15.0)(10^3)}$$

$$= 0.0298 \text{ (in)}$$

4-13



- $\Sigma F_x = 0$; $F_{AC} \cdot \sin 60 \cdot 2 = P$

$$F_{AC} = 0.5774 \cdot P$$

- $\delta_{AC} = \frac{F_{AC} \cdot L_{AC}}{A_{AC} \cdot E} = \frac{0.5774 P \cdot \frac{4}{\sin 60}(12)}{0.15(28.0)(10^3)}$

$$= 0.001524 \cdot P$$

- $\delta_A = \frac{\delta_{AC}}{\cos 30} = \frac{0.001524 P}{\cos 30}$

$$= 0.00176 P$$

- $\delta_{B/A} = \frac{F_{AB} \cdot L_{AB}}{A_{AB} \cdot E} = \frac{P(6)(12)}{0.15(28.0)(10^3)}$

$$= 0.003429 P$$

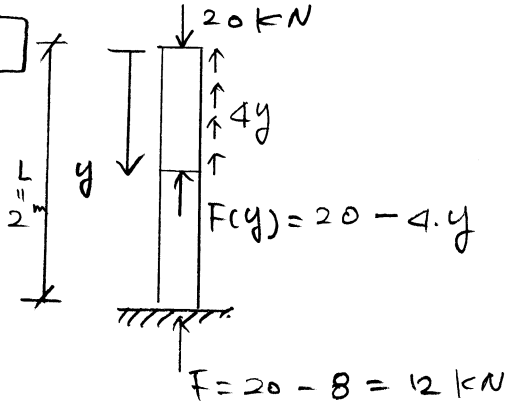
$$\delta_B = \delta_A + \delta_{B/A}$$

$$= 0.00176 P + 0.003429 P$$

$$= 0.08$$

$$\therefore P = 15.42 \text{ (kip)}$$

4-24



$$\delta_{A/B} = \int_0^L \frac{F(y) \cdot dy}{A(y) E}$$

$$= \frac{1}{AE} \int_0^2 (20 - 4y) dy$$

$$= \frac{1}{AE} \left[20y - 2y^2 \right]_0^2$$

$$= \frac{32 \text{ kN} \cdot \text{m}}{AE}$$

$$= \frac{32 \times 10^3}{\frac{\pi}{4}(0.06^2)(13.1)(10^9)}$$

$$= 0.8639 \times 10^{-3} \text{ (m)} = 0.864 \text{ (mm)}$$