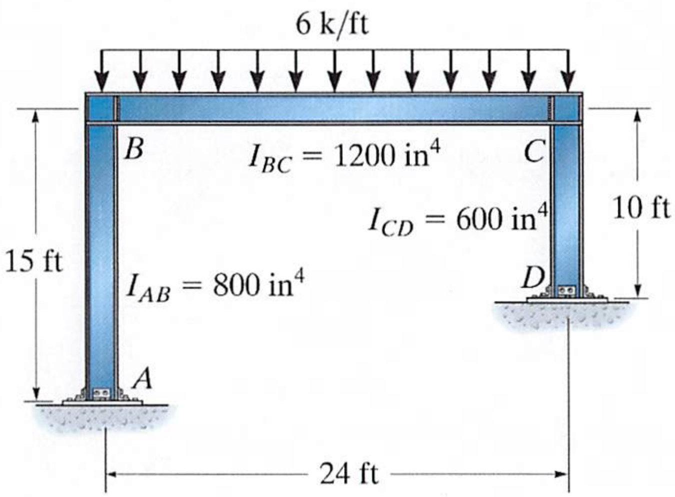
Problem 10c-2 – Determine the moments acting at the ends of each member. Assume the supports at *A* and *D* are fixed, and *E* = 29(10³) ksi.



$$\underline{I_{AB} = \tfrac{4}{3} I_{CD}} \qquad \underline{I_{BC} = 2 I_{CD}} \qquad \psi = \frac{\Delta}{L}$$

$$FEM_{BC} \Rightarrow \frac{WL^2}{12} = \frac{6k/ft(24')^2}{12} = \pm 288\ k\text{ft}$$

$$\xrightarrow{\text{JOINT B}} \quad M_{BA} + M_{BC} = 0 \quad (7)$$

$$M_{AB} = \frac{2E(4/3 I_{CD})}{15'}\left[\theta_B - 3\left(\frac{\Delta}{15'}\right)\right] \quad (1)$$

$$\xrightarrow{\text{JOINT C}} \quad M_{CB} + M_{CD} = 0 \quad (8)$$

$$M_{BA} = \frac{2E(4/3 I_{CD})}{15'}\left[2\theta_B - 3\left(\frac{\Delta}{15'}\right)\right] \quad (2)$$

$$M_{BC} = \frac{2E(2I_{CD})}{24'}\left[2\theta_B + \theta_C\right] - 288\ k\text{ft} \quad (3)$$

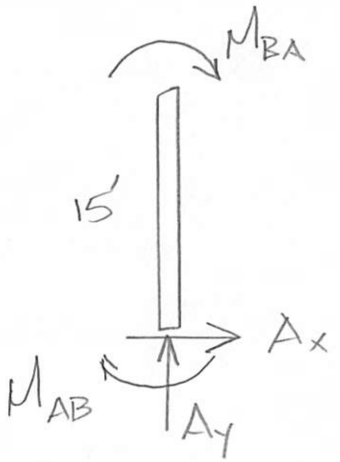
$$M_{CB} = \frac{2E(2I_{CD})}{24'}\left[2\theta_C + \theta_B\right] + 288\ k\text{ft} \quad (4)$$

$$M_{CD} = \frac{2EI_{CD}}{10'}\left[2\theta_C - 3\left(\frac{\Delta}{10'}\right)\right] \quad (5)$$

$$M_{DC} = \frac{2EI_{CD}}{10'}\left[\theta_C - 3\left(\frac{\Delta}{10'}\right)\right] \quad (6)$$

Problem 10c-2 – Determine the moments acting at the ends of each member. Assume the supports at *A* and *D* are fixed, and *E* = 29(10³) ksi.

SECTION AB

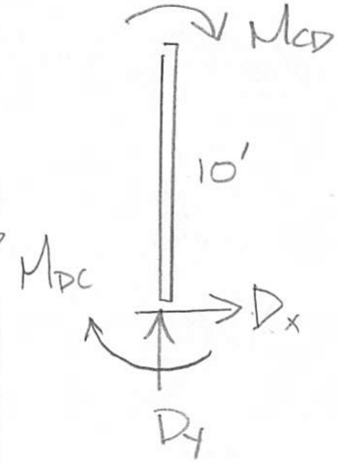


$$\circlearrowleft^{+} \sum M_B = 0$$

$$= -M_{BA} - M_{AB} + A_x(15')$$

$$A_x = \frac{M_{BA} + M_{AB}}{15'}$$

SECTION CD

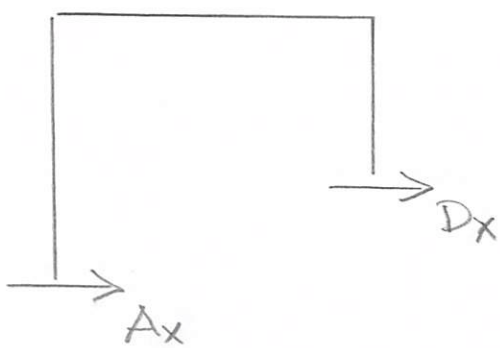


$$\circlearrowleft^{+} \sum M_C = 0$$

$$= -M_{CD} - M_{DC} + D_x(10')$$

$$D_x = \frac{M_{CD} + M_{DC}}{10'}$$

FBD ABCD



$$\xrightarrow{+} \sum F_x = 0 = A_x + D_x$$

$$M_{BA} + M_{AB} + \frac{3}{2}\left[M_{CD} + M_{DC}\right] = 0 \quad (9)$$

Problem 10c-2 – Determine the moments acting at the ends of each member. Assume the supports at *A* and *D* are fixed, and $E = 29(10^3)$ ksi.

(7) $M_{BA} + M_{BC} = 0 = \frac{2E(4/3\, I_{CD})}{15'}\left[2\theta_B - \frac{3\Delta}{15}\right] + \frac{2E(2I_{CD})}{24'}\left[2\theta_B + \theta_C\right] - 288\text{ kft}$

$$0.6889\,\theta_B + 0.1667\,\theta_C - 0.0356\,\Delta = \frac{288\text{ kft}^2}{EI_{CD}} \quad (7)$$

(8) $M_{CB} + M_{CD} = 0 = \frac{2E(2I_{CD})}{24'}\left[2\theta_C + \theta_B\right] + 288\text{ kft} + \frac{2EI_{CD}}{10'}\left[2\theta_C - \frac{3\Delta}{10'}\right]$

$$0.1667\,\theta_B + 0.7333\,\theta_C - 0.06\Delta = -\frac{288\text{ kft}^2}{EI_{CD}} \quad (8)$$

(9) $M_{BA} + M_{AB} + 3/2(M_{CD} + M_{DC}) = 0$

$$= \frac{2E(4/3\, I_{CD})}{15'}\left[2\theta_B - \frac{3\Delta}{15'}\right] + \frac{2E(4/3\, I_{CD})}{15'}\left[\theta_B - \frac{3\Delta}{15'}\right]$$

$$+ \frac{3}{2}\left[\frac{2EI_{CD}}{10'}\left[2\theta_C - \frac{3\Delta}{10'}\right] + \frac{2EI_{CD}}{10'}\left[\theta_C - \frac{3\Delta}{10'}\right]\right]$$

$$0.5333\,\theta_B + 0.9\,\theta_C - 0.2511\,\Delta = 0 \quad (9)$$

Problem 10c-2 – Determine the moments acting at the ends of each member. Assume the supports at *A* and *D* are fixed, and *E* = 29(10^3) ksi.

SOLVED EQNS 7, 8, & 9 USING EXCEL

$$\theta_B = \frac{507.4804 \text{ kft}^2}{EI_{CD}} \qquad \theta_C = -\frac{594.1733 \text{ kft}^2}{EI_{CD}} \qquad \Delta = -\frac{1{,}051.8388 \text{ kft}^2}{EI_{CD}}$$

$$M_{AB} = \frac{2E(4/3 I_{CD})}{15'}\left[\theta_B - \frac{3\Delta}{15}\right] = \underline{127.62 \text{ kft}}$$

$$M_{BA} = \frac{2E(4/3 I_{CD})}{15'}\left[2\theta_B - \frac{3\Delta}{15}\right] = \underline{217.84 \text{ kft}}$$

$$M_{BC} = \frac{2E(2I_{CD})}{24'}\left[2\theta_B + \theta_C\right] - 288 \text{ kft} = \underline{-217.87 \text{ kft}}$$

$$M_{BA} + M_{BC} = 0$$

$$M_{CB} = \frac{2E(2I_{CD})}{24'}\left[2\theta_C + \theta_B\right] + 288 \text{ kft} = \underline{174.52 \text{ kft}}$$

$$M_{CD} = \frac{2EI_{CD}}{10'}\left[2\theta_C - \frac{3\Delta}{10'}\right] = \underline{-174.56 \text{ kft}}$$

$$M_{CB} + M_{CD} = 0$$

$$M_{DC} = \frac{2EI_{CD}}{10'}\left[\theta_C - \frac{3\Delta}{10'}\right] = \underline{-55.72 \text{ kft}}$$