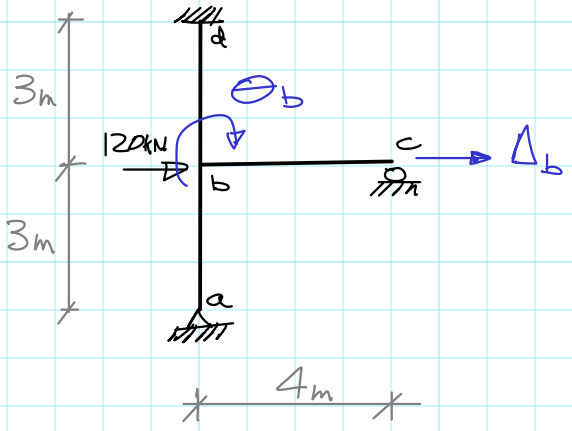
Problem 10.2.6-8 (Partial Solution)



2 DOF: θ_b, Δ_b

($M=0$ @ a & c, ∴ rotations not needed)

Joint b (& c) can translate rightward

Fixed end moments

all are 0 (no lateral loads on members; 120 kN load is applied to joint b)

Slope Deflection

$$M_{ab} = 0$$

$$M_{ba} = \frac{EI}{3}\left(3\theta_b - 3\frac{\Delta_b}{3}\right) = EI\theta_b - \frac{EI}{3}\Delta_b$$

$$M_{bc} = \frac{EI}{4}(3\theta_b) = \frac{3}{4}EI\theta_b$$

$$M_{cb} = 0$$

$$M_{bd} = \frac{EI}{3}\left(4\theta_b + 6\frac{\Delta_b}{3}\right) = \frac{4}{3}EI\theta_b + \frac{2}{3}EI\Delta_b$$

$$M_{db} = \frac{EI}{3}\left(2\theta_b + 6\frac{\Delta_b}{3}\right) = \frac{2}{3}EI\theta_b + \frac{2}{3}EI\Delta_b$$

see note

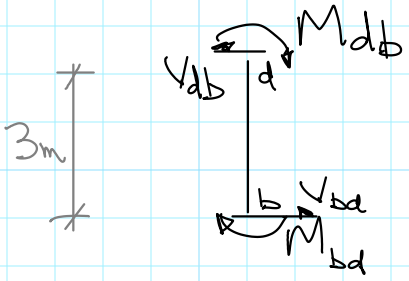
Note - assume Δ_b rightward.
∴ chord ab rotates clockwise, ∴ sign of $\frac{\Delta}{L}$ is +ive as per S.D. sign conv. rtn

chord bd rotates counterclockwise, ∴ sign of $\frac{\Delta}{L}$ is negative & term is added (− − = +)

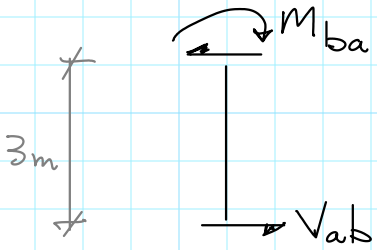
Equilibrium Equations (need 2, for 2 unknowns)

1) $M_{ba} + M_{bc} + M_{bd} = 0$ (rotational equilib @ joint b)

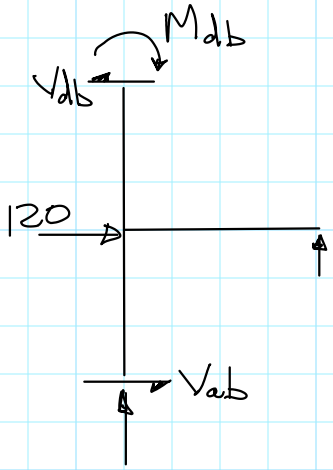
Up to now - the 120 kN load has not appeared anywhere - now it will:



$$V_{db} = \frac{M_{db} + M_{bd}}{3}$$



$$V_{ab} = \frac{M_{ba}}{3}$$



2) $\Sigma F_x = 0$

$$120 + V_{ab} - V_{db} = 0$$

Subst above eqns & get one in terms of θ_b, Δ_b

Solve

Solve for θ_b, Δ_b

Back Substitute

Into SD Eqns to get end moments.