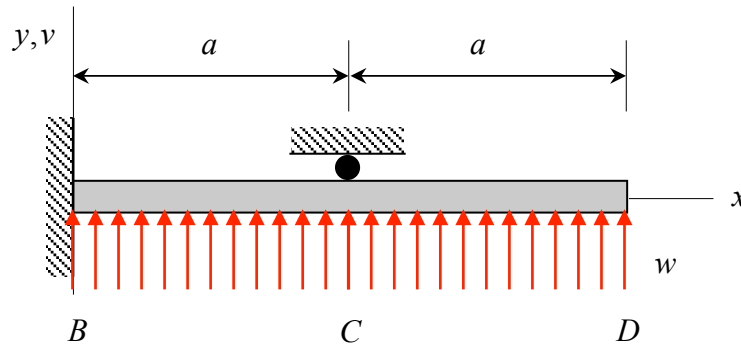


Rework Homework H17 using the superposition approach. Clearly indicate your choice of beam deflection component problems that go together to make up the total deflection of the original beam.



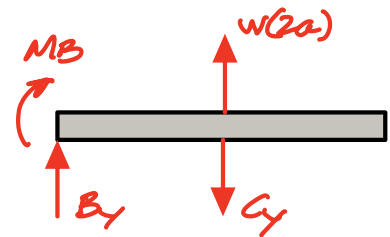
1. Equilibrium - ext. reactions

$$\sum M_B = -M_B + (2wa)a - C_y a = 0$$

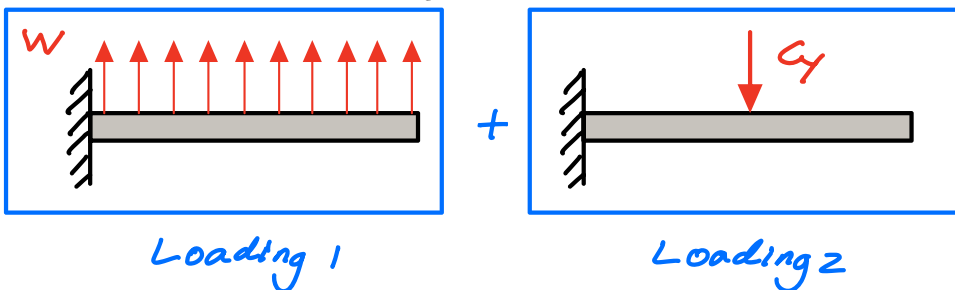
$$(1) \hookrightarrow M_B = 2wa^2 - C_y a$$

$$\sum F_y = B_y - C_y + 2wa = 0$$

$$\hookrightarrow B_y = C_y - 2wa$$



2. Load/deformation - using superposition



$$V_1(x) = \frac{1}{24} [x^2(24a^2 - 8ax + x^2)] \frac{w}{EI} \quad ; \quad 0 < x < 2a$$

$$V_2(x) = -\frac{1}{6} [x^2(3a-x)] \frac{C_y}{EI} \quad ; \quad 0 < x < a$$

$\therefore$  for  $0 < x < a$ :

$$V(x) = V_1(x) + V_2(x)$$

$$= \frac{1}{24} [x^2(24a^2 - 8ax + x^2)] \frac{w}{EI} - \frac{1}{6} [x^2(3a-x)] \frac{C_y}{EI}$$

### 3. Compatibility - enforce BC at C

$$v_c = v(a) = 0 = \frac{1}{24} [a^2(24a^2 - 3a^2 + a^2)] \frac{W}{EI} - \frac{1}{6} [a^2(3a-a)] \frac{C_y}{EI}$$

$$(3) \quad \hookrightarrow 0 = \frac{17}{24} \frac{Wa^4}{EI} - \frac{1}{3} \frac{C_y a^3}{EI}$$

### 4. Solve

$$(3) \Rightarrow C_y = \frac{17}{8} Wa$$

$$(1) \Rightarrow M_B = 2Wa^2 - \left(\frac{17}{8} Wa\right)a = -\frac{Wa^2}{8}$$

$$(2) \Rightarrow B_y = \frac{17}{8} Wa - 2Wa = \frac{Wa^2}{8}$$

$C_y$

$M_B$

$B_y$