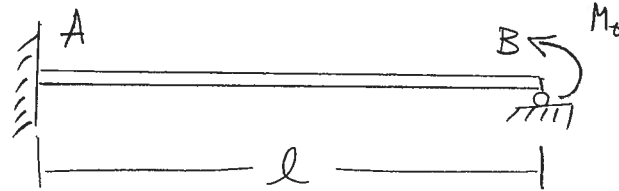
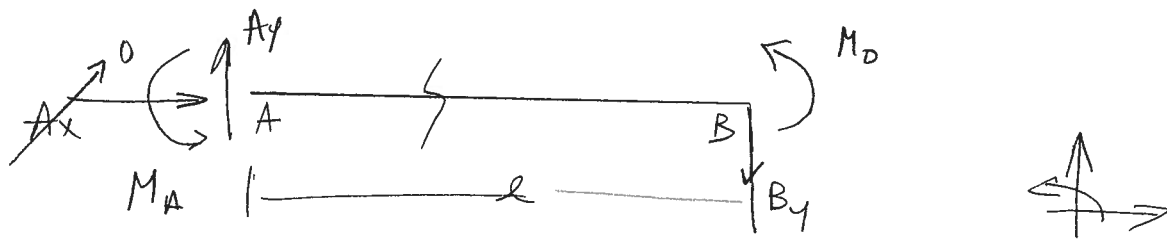


Use the method of double integration to calculate the reactions for the beam loaded as shown.



First sketch a F.B.D. of the beam



This problem is indeterminate to the 1st degree.

Select a redundant. The redundant must be selected so that if it is removed the beam will remain stable and determinate.

In this case we will select B_y

Next, we solve for the remaining reactions in terms of applied load and the redundant.

$$\sum F_y = 0$$

$$(1) \quad A_y - B_y = 0$$

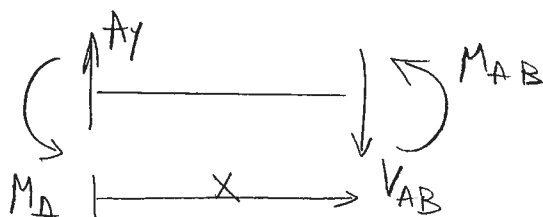
$$(2) \quad A_y = B_y$$

$$\sum M_A = 0$$

$$(3) \quad M_A + M_0 - B_y l = 0$$

$$(4) \quad M_A = B_y l - M_0$$

Next we write the moment equation for the beam. Note that only one equation is required to cover the entire beam



$$\sum M_{cut} = 0$$

$$(5) \quad M_{AB} - A_y x + M_A = 0$$

$$(6) \quad M_{AB} = A_y x - M_A$$

Next we write the differential equation

$$(7) \quad EI \frac{d^2 y}{dx^2} = A_y x - M_A$$

$$(8) \quad EI \frac{dy}{dx} = \frac{A_y}{2} x^2 - M_A x + C_1$$

$$(9) \quad EI y = \frac{A_y}{6} x^3 - \frac{M_A}{2} x^2 + C_1 x + C_2$$

Next apply boundary conditions

$$(10) \quad @ x=0, \frac{dy}{dx} = 0$$

$$(10) \quad 0 = 0 - 0 + C_1$$

$$(11) \quad \underline{C_1 = 0}$$

$$(12) \quad @ x=0, y=0$$

$$(12) \quad 0 = 0 - 0 + 0 + C_2$$

$$(13) \quad \underline{C_2 = 0}$$

$$(14) \quad @ x=l, y=0$$

$$(14) \quad 0 = \frac{A_y}{6} l^3 - \frac{M_A}{2} l^2 + 0 + 0$$

Then we plug in equations (2) and (4)

$$(15) \quad \frac{A_y}{6} l^3 = \frac{M_A}{2} l^2$$

$$(16) \quad \frac{B_y}{6} l^3 = \frac{l^2}{2} (B_y l - M_0)$$

$$(17) \quad \frac{B_y l^3}{6} (3-1) = \frac{l^2}{2} M_0$$

$$(18) \quad B_y = \frac{6}{2(2)} \frac{M_0}{l}$$

$$(19) \quad \underline{B_y = \frac{3}{2} \frac{M_0}{l}} \quad \downarrow \quad \text{as shown}$$

$\therefore$

From equation (2)

$$(20) \quad \underline{A_y = \frac{3}{2} \frac{M_0}{l}} \quad \uparrow \quad \text{as shown}$$

From equation (4)

$$(21) \quad M_A = \frac{3}{2} \frac{M_0}{l} l - M_0$$

$$(22) \quad \underline{M_A = \frac{M_0}{2}} \quad \uparrow \quad \text{as shown}$$

Summary of Results

