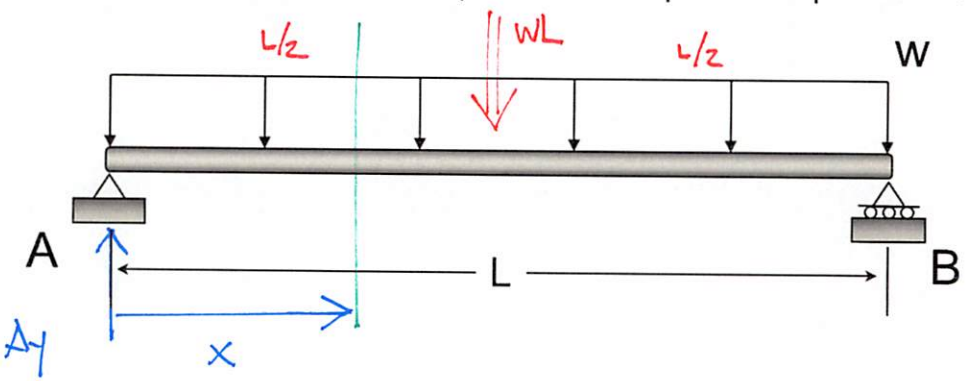
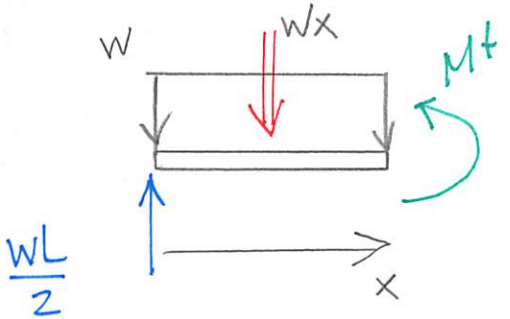
Example 7a-1: Determine the equations for slope and displacement in the following beam.



F d

$$\circlearrowleft \sum M_B = 0 = WL\left(\frac{L}{2}\right) - A_y L$$

$$A_y = \frac{WL}{2}$$



$$\circlearrowleft \sum M_{CUT} = 0 = M + Wx\left(\frac{x}{2}\right) - \frac{WL}{2}x$$

$$M(x) = \frac{W}{2}\left[-x^2 + Lx\right]$$

$M(x=0) = 0$ ✓

$M(x=L) = 0$ ✓

$$\theta = \int \frac{M}{EI}dx = \frac{W}{2EI}\left[-\frac{x^3}{3} + \frac{Lx^2}{2}\right] + C_1$$

$$y = \int \theta dx = \frac{W}{2EI}\left[-\frac{x^4}{12} + \frac{Lx^3}{6}\right] + C_1 x + C_2$$

$y(x=0) = 0 = C_2$

$$y(x=L) = 0 = \frac{WL^4}{24EI} + C_1 L$$

$y_{MAX} = ?$ 1) $\theta = 0$ FIND x_1

$$C_1 = -\frac{WL^3}{24EI}$$