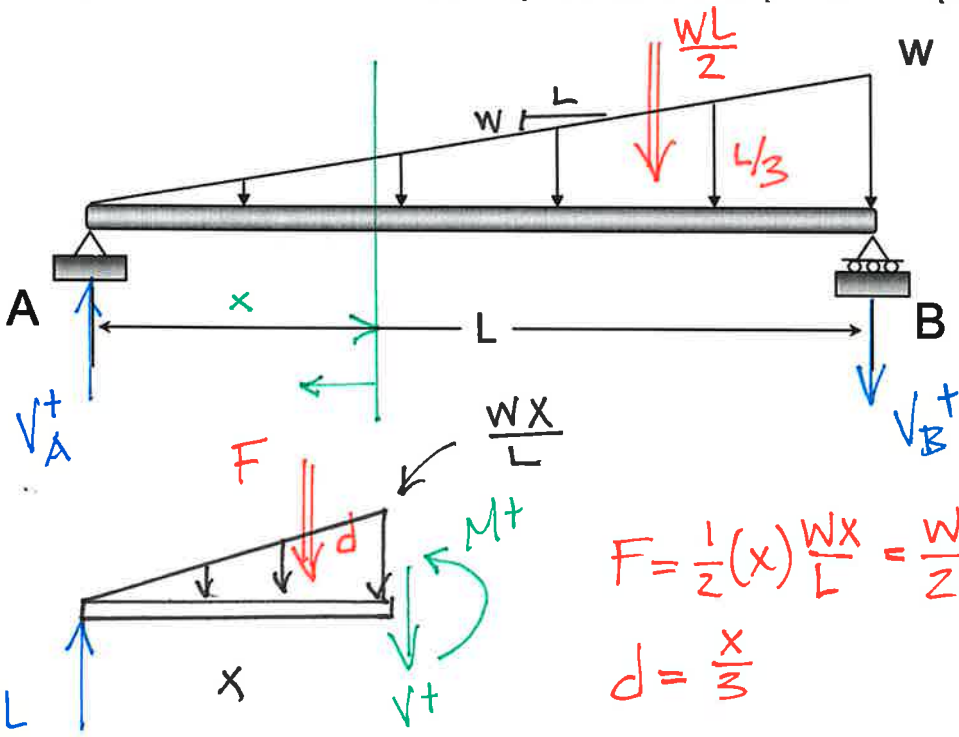
Example 7a-2: Determine the equations for slope and displacement in the following beam.



$$F = \frac{1}{2}(x)\frac{Wx}{L} = \frac{Wx^2}{2L}$$

$$d = \frac{x}{3}$$

$$\circlearrowleft \Sigma M_B = 0 = \frac{WL}{2}\left(\frac{L}{3}\right) - V_A(L)$$

$$V_A = \frac{WL}{6}$$

$$+\uparrow \Sigma F_y = 0 = V_A - V_B - \frac{WL}{2}$$

$$V_B = -\frac{WL}{3}$$

$$\circlearrowleft \Sigma M_{CUT} = 0 = M + \frac{Wx^2}{2L}\left(\frac{x}{3}\right) - \frac{WL}{6}x$$

$$M(x) = \frac{W}{6}\left[\frac{-x^3}{L} + Lx\right]$$

$M(x=0) = 0$ ✓ $\quad M(x=L) = 0$ ✓

$$EI\theta = \int M\,dx = \frac{W}{6}\left[-\frac{x^4}{4L} + \frac{x^2L}{2}\right] + C_1$$

$$Y = \int \theta\,dx = \frac{W}{6EI}\left[-\frac{x^5}{20L} + \frac{x^3L}{6}\right] + C_1x + C_2$$

$$Y(x) = \frac{W}{6EI}\left[-\frac{x^5}{20L} + \frac{x^3L}{6} - \frac{7xL^3}{60}\right]$$

$$Y(x=0) = 0 = C_2$$

$$Y(x=L) = 0 = \frac{W}{6EI}\left[\frac{7L^4}{60}\right] + C_1L$$

$$C_1 = -\frac{W}{6EI}\left[\frac{7L^3}{60}\right]$$