a) $v(0)=0$ (1) $v(L)=-2\,mm$ (1)

$\theta(0)=0$ (1)

Common mistakes: Trying to come up with a B.C. at $\theta(L)$, e.g $\tan(\theta(L))=\frac{2}{80}$

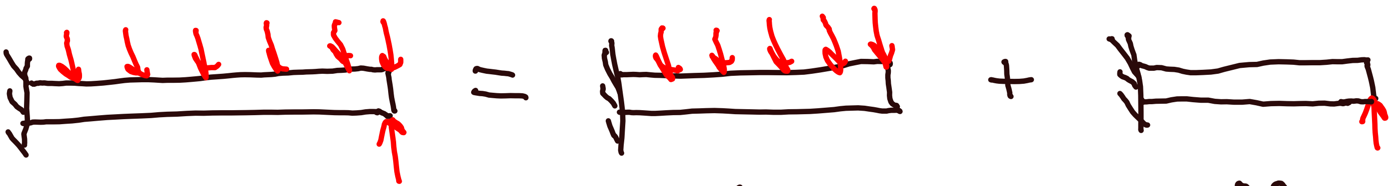
b)

$\Sigma F_y = A_y + P - p_oL = 0$

$(\Sigma M)_A = -M_A - p_oL\left(\frac{L}{2}\right) + PL = 0$

Common mistake: Forgetting the reaction moment (M_A) at the left side.

c) Superposition approach



$V_{po} = \frac{-p_o x^2}{24EI}\left(6L^2 - 4Lx + x^2\right)$ $V_P = \frac{Px^2}{6EI}(3L - x)$

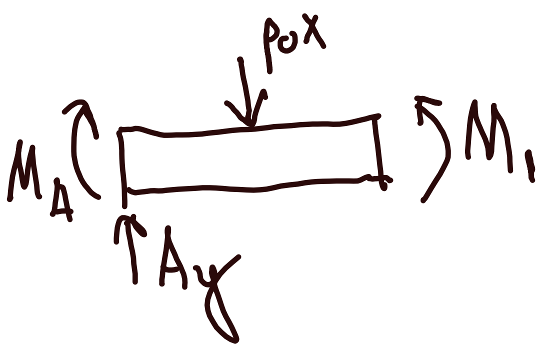
$v(x) = v_{po}(x) + v_P(x)$

$v(L) = -0.002m = -\frac{p_oL^4}{8EI} + \frac{PL^3}{3EI}$

$p_o = 0.689\ N/m$

Common mistakes:
- Treat distributed load as point load.
- Use polar area moment $\left(\frac{\pi}{2}R^4\right)$ instead of second area moment $\left(\frac{\pi}{4}R^4\right)$

Second order approach



$$(\Sigma M)_1 = M_1 - M_A - A_y x + p_0 x\left(\frac{x}{2}\right) = 0$$

$$M_1 = M_A + A_y x - p_0 \frac{x^2}{2}$$

$$\theta(x) = \cancelto{0}{\theta(0)} + \frac{1}{EI}\int_0^x M_1 \, dx$$

$$\theta(x) = \frac{1}{EI}\left[M_A x + A_y \frac{x^2}{2} - p_0 \frac{x^3}{6}\right]$$

$$v(x) = \cancelto{0}{v(0)} + \int_0^x \theta \, dx$$

$$v(x) = \frac{1}{EI}\left[M_A \frac{x^2}{2} + A_y \frac{x^3}{6} - p_0 \frac{x^4}{24}\right]$$

$$\boxed{\begin{aligned} A_y &= -P + p_0 L \\ M_A &= PL - p_0 \frac{L^2}{2} \end{aligned}}$$

$$v(L) = -0.002\,m = \frac{1}{EI}\left[\frac{PL^3}{2} - \frac{PL^3}{6} - p_0 \frac{L^4}{4} + p_0 \frac{L^4}{6} - p_0 \frac{L^4}{24}\right]$$

$$\Rightarrow p_0 = 0.689 \text{ N/m}$$