1. Obtain an approximate displacement equation for the simply supported beam shown in the figure below

Using the trial solution

\[ y = -A \sin \left( \frac{\pi x}{H} \right) \]

find a value for the constant “\( A \)” that satisfies the governing differential equations

\[
EI \frac{d^2 y}{dx^2} - \frac{P x}{2} = 0 \quad 0 \leq x \leq \frac{H}{2}
\]

\[
EI \frac{d^2 y}{dx^2} - \frac{P}{2} (H - x) = 0 \quad \frac{H}{2} \leq x \leq H
\]

Use the value of \( A \) in the sine function above and compare values from the sine function expression and the expression (theoretical solution)

\[
y = \frac{P}{48EI} \left[ 4x^3 - (3H^2)x \right] \quad x \leq \frac{L}{2}
\]
at the quarter points of the beam. Invoke symmetry with the expression immediately above.

Finally evaluate the constant “A” by minimizing the integral

$$\Pi = \int_0^H \frac{EI}{2} \left( \frac{dy}{dx} \right)^2 dx + \int_0^{H/2} P \frac{x y}{2} dx + \int_{H/2}^H \frac{P}{2} (H - x) y dx$$

2. Problem 3.6 in Logan’s textbook

3. Consider the rod shown below where the axial strain at any point $x$ is given by

$$\epsilon_x = 1 + 2x^2$$

Find the axial displacement $\delta$ at the tip of the rod.